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Permanent Liquidator Appointed for Abitibi

Master of Supreme Court Names F. C. Clarkson to Post In Interest of All Parties Concerned—Receiver G. T. Clarkson Intimates Formation of Plan for Re-Establishment of Company by Favorable Reorganization—Woodfibre and Port Alice Plants of British Columbia Pulp & Paper Co. to Operate This Winter

[FROM OUR REGULAR CORRESPONDENT]

TORONTO, November 21, 1932—The Master of the Supreme Court at Osgoode Hall yesterday decided, after much argument, that the interests of all parties concerned would be best served by naming F. C. Clarkson permanent liquidator of the Abitibi Power and Paper Company. Mr. Clarkson is a brother of G. T. Clarkson, receiver for the company. "I have given this matter a great deal of consideration," the Master said. "I feel that this is a very important winding up matter. I am painfully cognizant of the fact that this is an unusual period of history in Ontario and that there has never been greater depression. In this case, as in any other, I want to be possessed of all the facts." The Master added that he was not there to approve the decisions or recommendations of the liquidator or receiver. "What we want to do in this case is to put the company on its feet to do business." He spoke of the attitude of the Shareholders Protective Association and of the intimation from G. T. Clarkson, receiver, that there was a plan for the re-establishment of the company by some honest, favorable reorganization. He therefore appointed F. C. Clarkson as permanent liquidator. According to the receiver's report creditors' claims filed and admitted were $610,848; claims filed and under adjustment, $163,593; claims indicated by the books of the company, but not filed, $63,892; claims under dispute, $3,119.

Hinde & Dauch to Make Box Boards

Simultaneously with the closing down of the Canadian Paperboard Company's Toronto plant at the middle of November came the official announcement that the Hinde & Dauch Paper Company of Canada, Ltd., Toronto, manufacturers of jute, chip and container board and solid fiber and corrugated boxes had extended its mill service to include all general grades of box boards. For the past month the company has been revamping the equipment of its Toronto mill in order to make it suitable in every way for the production of box board grades. It was also announced that F. F. Arnoldi, late of the Canadian Paperboard Company's staff had been appointed sales manager. The five cylinder machine in the No. 1 Toronto mill which has now been turned over to the manufacture of box board grades is now in production with an estimated daily capacity of 45 or 50 tons. The production of the Toronto plants has hitherto consisted of solid fiber and corrugated shipping cases, corrugated and solid fiber sheets, pads, partitions and roll stocks, container boards and test liners, chip boards, mill boards, backing boards and box boards. The company also operates box factories at Montreal and Trenton, Ont., straw paper being manufactured at the latter point.

British Columbia Mills To Resume

Although pulp markets continue depressed, British Columbia Pulp and Paper Company will have both mills operating this winter, according to Lawrence W. Killam, president. Until recently both mills were shut down. The company operates one plant at Port Alice and another at Woodfibre, producing white sulphite chiefly. The Woodfibre plant, shut down early in the spring, re-opened October 1, although at the time this re-opening was regarded as temporary. Now, the company has decided to keep this plant running and in addition to re-open the Port Alice plant, which has not been running since May. "Re-opening our mills at this time does not mean that we have found a substantial improvement in the market," said Mr. Killam. "We recognize the importance of keeping industry moving, however, and of maintaining employment. We have been selling from stored stock since early in the summer and still have some stocks left."

Robert Gair Co. Takes Over Firstbrook

Shareholders of Firstbrook Boxes, Ltd., Toronto, at a general meeting called by the receiver of the company on November 16, agreed to accept the offer of the Robert Gair Company, of New York, for the acquisition of the Canadian firm. The Gair company, engaged in a similar line of manufacture, and one of the largest companies of its kind, offered to buy the assets of the company on a basis of bond for bond, with the payment of extra bonds for overdue interest. Under the arrangement just effected the unsecured or trade creditors of Firstbrook Boxes will receive 5 per cent. non-cumulative and non-voting stock in the new company and the preferred shareholders of Firstbrook Boxes will receive five shares of the new common stock for each share of the old preferred issue. The common shareholders will receive one share in the new company for twenty shares of Firstbrook Boxes, and under the terms of the agreement the Gair company is to place

(Continued on page 46)

Paper Mill Activities in Fox River Valley

New Corporation Formed to Acquire All Assets of Tomahawk Kraft Paper Co. and Mosinee Paper Mills Co.—Merger of Two Large Kraft Paper Organizations Should Effect Economies to Offset Unfavorable Market Conditions

[FROM OUR REGULAR CORRESPONDENT]

APPLETON, Wis., November 21, 1932.—Steps to put into effect the proposed merger recently announced of the Tomahawk Kraft Paper Company, Tomahawk, Wis., and the Mosinee Paper Mills Company, Mosinee, Wis., are being taken by the two companies. Bondholders have been notified of the plans.

A new corporation to acquire all assets of the old concerns by an exchange of securities is planned. It is proposed to exchange a bond of $1,000 for $300 par value of new first mortgage bonds, about $180 par value of new income debentures and 40 shares of common stock in the new company.

Capital of the new company is to consist of 300,000 shares of no par common stock. Six per cent bonds totalling $1,500,000 are to be issued, and debentures with a six per cent income are also to be offered.

The owners of the two large kraft mills believe economies will be effected sufficient to overcome the unfavorable marketing conditions existing for some time.

Court Decision in Favor of Marinette

A court decision has been handed down in favor of the Marinette and Menominee Paper Company, Marinette, Wis., that will save the company thousands of dollars. Judge Robert S. Cowie, of the circuit court, reversed the jury's verdict in a case in which Herman Rader, a farmer, sought damages from the Union Falls Power Company, a subsidiary of the above paper company, for alleged damage to his farm from the raising of the Park dam on the Menominee river.

The case is one of twenty started by land owners, alleging their property was affected adversely by raising of the dam in 1920 when higher splash boards had been used than allowed by the then railroad commission. It was admitted that the dam had been raised two and a half feet without such permission being obtained.

Judge Cowie ruled that the plaintiff had failed to establish any evidence of damage. His decision concluded "that as to lay evidence, it is wholly insufficient to lay any such foundation whereon the expert evidence is based. It is no answer to say that plaintiff's experts reason from condition to probable cause, because every element upon which such probable cause is grounded appears to me fully explained by other causes."

News of the Industry

Flambeau Paper Company, Park Falls, Wis., has announced that it will begin buying pulp wood from farmers in anticipation of the operation of its mill. The operating situation was doubtful for a time because of the competition of cheaper foreign pulp, but the company decided to continue its policy of buying wood locally.

The job analysis of all production jobs in paper mills of the United States has been completed jointly by the Federal Board of Vocational Education and the Technical Association of the Pulp and Paper Industry. H. G. Noyes, Appleton, acted as chairman of the committee on education of TAPPI in compiling and recording the material. Copies have been prepared and are being reviewed ready for release. Information was compiled in Wisconsin, Maine, New York, Massachusetts, Ohio and Louisiana last spring and summer.

Because of the repairs on a water power flume, the Union Bag and Paper Company mill at Kaukauna, Wis., was closed down for several days. A crew of fifteen men worked on the project and the mill has again resumed operations.

Official closing of navigation for the winter on the Fox River is set for November 19, according to Nelson Wightman, government engineer, somewhat earlier than usual. The time was advanced so the government can start work on a three year building program at the Rapid Croche power dam. Preliminary work will be done on the dam this winter and part of the walls will be constructed. Machinery and building materials are already at the scene of operations.

Tugs and barges of the Fox River Navigation Company, co-operative shipping company supplying coal to paper mills of the Fox River Valley have been taken off the river, according to Ben Prugh, manager. Two tugs and two barges will be placed in drydock for repairs and about half of the crew retained on the boats will be used.

Vocational School Talks Create Interest

Addresses being made to night school classes in pulp and paper making at vocational schools of paper mill centers are creating a great deal of interest. At Green Bay, Wis., last week, L. J. McNamara, director of paper and pulp mill education in mills of the Fox River Valley, spoke on "Paper Making Materials." A film from the United States Forest Products Laboratory, Madison, Wis., was shown and explained by H. G. Noyes, state paper education director. The speakers covered such phases as properties of wood, sulphur, lime, water, clay, size, dye stuffs and loading materials. A discussion followed.

At Marinette, Wis., the personal side of the worker's connection with the paper mill was presented in a philosophical vein by W. J. Peacock, personnel officer of the Northern Paper Mills, Green Bay, Wis. He traced the progress of men from the priminitive days when he did everything himself and supplied practically all his own wants, and the present day with its specialization. He gave a parallel illustration of the paper industry, telling how it had not been lacking in resourcefulness and imagination, and today was producing novelties such as rayon, wall board, mulch paper, cellophane wrapping, paper soles, laminated packing pads, rugs, milk bottles, polishing and dusting papers, handkerchiefs and even diapers. He appealed for loyalty of pulp makers in the fight waged by mills to keep going against Swedish competition. "Willingness, eagerness, adaptability and desire to work with others ought to come naturally for those who are alive to conditions," he said.

Two paper mill workmen met death during the last week. Lloyd Cramer, 35, suffered a broken neck and other injuries that proved fatal when his hand became caught in a pulley while working at the Badger Paper Mills, Peshtigo, Wis. He was drawn into a conveyor in the sulphite mill.

Paul Shepanik, while on his way to work at the Mosinee Paper Mills Co., Mosinee, Wis., after dark, was killed by a shot gun just outside the plant.

Demand for Paper Falls Off in Philadelphia

Advance In Trading Foreshadowed In Early November Fails to Realize — Various Standard Grades of Fine Paper Only Moving Slowly Following Ending of Special Election Business —Coarse Paper Market Unsettled, With Prices Easier

[FROM OUR REGULAR CORRESPONDENT]

PHILADELPHIA, Pa., November 21, 1932—Expectations of the preceding week, perhaps a little too high, were not realized during the past week. It is not to be inferred that the trade is at all alarmed, hardly even disappointed, but it is none the less true that the advance which seemed to have been foreshadowed so clearly in early November, has not been realized in the fine paper division and certainly not in either the coarse paper or the paper stock branches.

Fine paper dealers report a natural falling off in the requirements of the printing trade, due to the ending of special election business and a backwardness in demand for the coming holiday season. There have been neither reductions in quotations nor demand for such, but at the same time prices are not regarded as firm. In the coarse paper division, prices generally are quite soft and there have been fractional concessions in certain lines, particularly the brown coarse papers which have come in so splendidly in recent years from the southern producers.

Passing of Thomas R. Fort, Jr.

The passing of Thomas R. Fort, Jr., whose death was announced last week and who was laid to rest on Monday afternoon, November 14, removes from the trade one of its most prominent and unquestionably one of its most upstanding and well beloved members. It is doubtful, whether, in trade annals, a larger and more representative outpouring of all interested in the paper trade in its widest application, ever took place than the great throng which paid their last respects to Mr. Fort from the funeral parlors of Robert R. Bringhurst, with whom, incidentally, Mr. Fort was associated in City Council many years ago. Noted in the gathering were not only the executives of all the paper houses in Philadelphia but representatives of the sales forces, and even of the drivers of trucks used in hauling of paper and of paper stock, because all who ever came in contact with Mr. Fort, were in his eyes on an equality.

The trade regarded him as a survival of that old high-type class of merchants which distinguished the life of Philadelphia in the times that have gone,—men like Thomas W. Price, into whose footsteps Mr. Fort stepped, and John Simmons, founder of John Simmons' Sons, with whom Mr. Fort was most intimate. Mr. Fort, with two associates in the old business of the Thomas W. Price Company, took over his interest when he passed on, and in the succeeding years, with the death of his two associates (all of them former employees of the Thomas W. Price Company) purchased their interests.

Originally the Price company occupied but one building at 509 Ludlow street (formerly Minor street) but the close application to business and the high plane on which it was conducted were of constant and steady growth. Usually movements of progress are westward but in this case the movement took an eastward direction, so that from time to time, adjoining buildings were occupied, and finally, but a few years ago, a large warehouse fronting on Fifth street, and once occupied by Curtis and Bro. became a part of the Thomas W. Price organization.

Mr. Fort always took an active interest in civic affairs and when he was chosen to represent his district in Council, it was with the approval of both the major parties and some of the minor ones, and he was elected without contest. He was prominent in the affairs of the Methodist Church and had enjoyed the highest honors which a church can confer upon a lay member—election as delegate to the General Conference. He was active in the First Methodist Church of Germantown. Though affected by illness for several years past, Mr. Fort never lost his intimate contact with the business, and until but a short time before his death he was in constant conference with his executives at his home at the seashore.

The Paper and Bag Institute of Philadelphia, of which Nathan D. Isen is president, Charles Rexnick, treasurer, Elwood Basler, vice president, and Lewis Gerber, secretary, held its regular meeting at the Elks Clubhouse, and widespread enthusiasm was manifest when the announcement was made that plans were being formulated to hold a banquet on a night in January or February that will be convenient for all to attend. They are sanguine of promoting a comraderie that will be conducive to a feeling of better cooperation between jobbers, manufacturers and salesmen, for to put it in their own words: Men who may harbor grievances against their competitors as a rule feel far more amicable when they have "broken bread" with them. The Institute has been no exception to the rule and the First Annual Banquet will do much to foster the high hopes of those in the paper trade. The Credit Bureau of the Institute is pleased to announce it has enlarged its quarters by the occupancy of additional space adjoining its present quarters at 2005 North American Building, Broad and Sansom streets, and extends a cordial invitation to all to visit them. Nathan D. Isen, president of the Institute, has been confined to his bed with a severe cold, but at this writing he is reported much improved and expects to be back at his desk in a day or two.

News of the Trade

E. J. Stoeser, widely known in paper mill circles and in the trade because of his long connection with the old Philadelphia Paper Manufacturing Company, Manayunk, now the Container Corporation of America, paid a visit to old friends in Philadelphia during the week. He will remain here until about December first. Mr. Stoeser was with the Philadelphia Paper Company for more than twenty-two years, and at the time of his retirement from it a little more than half a decade ago, was its secretary and treasurer. He is now a resident of Miami, Florida.

Two executives of the Container Corporation of America, Chicago, were in Philadelphia this week—Wesley Dixon, vice president in charge of sales, and J. J. Brossard, vice president in charge of production. The Philadelphia plant of the Container Corporation is installing a new Downingtown Extractor Roll, which they expect will be in operation this week; they have also made renovations to their Number 5 Machine—all of which is indicative of new business.

Boston Paper Merchants Hold Annual Meeting

Approximately One Hundred Members and Guests Attend Fall Meeting and Dinner of Boston Paper Trade Association At Exchange Club — Number of New Members Elected to Organization During Brief Business Meeting Preceding Banquet

[FROM OUR REGULAR CORRESPONDENT]

BOSTON, Mass., November 21, 1932—The fall meeting and dinner of the Boston Paper Trade Association was held at the Exchange Club Wednesday evening, with approximately 100 members and guests present. President Charles A. Esty was in the chair. A reception and reunion preceded the banquet. Group singing, at intervals, led by E. Lindsey Cummings, was one of the enlivening features of the dinner. A brief business meeting was held when the party sat down at the tables.

The following were elected regular members of the organization: Louis DeJonge, Louis DeJonge Company, proposed by Norman Harrower; Horace B. Sargent, E. Butterworth & Co., Inc., proposed by Thomas H. Casey; Donald R. Smith and Frederic T. Burkhardt, both of the Keith Paper Company, proposed by John W. Vivian; Rolf G. Westad, Waterfalls Paper Mills, proposed by Thomas H. Casey; S. Guy Ashley and John D. Zink, of The Old Colony Envelope Company, Inc., Walter B. Sheehan and Herbert E. Raymond, Missisquoi Corporation, all proposed by Norman Harrower, and Charles H. Dodge, proposed by Arthur M. Burr.

Alfred T. Carter, Pejepscot Paper Company, Inc., proposed by Floyd H. Blackman, was elected to limited membership. President Esty appointed the following as nominating committee to bring in names to be voted on at the annual meeting: Charles S. Proctor, J. W. Vivian, Charles Baird and M. L. Madden.

Carl P. Dennett Discusses National Debt

After cigars were lighted, the toastmaster introduced Carl P. Dennett, chairman of the Massachusetts Branch of the National Economy League, as the speaker, referring to him as an industrialist and a banker.

Mr. Dennett, discussing the "Purposes, Needs and Opportunities of the League," mentioned in his opening remarks the national debt. He noted that in 1913 it was $2,900,000,000; in 1916, $4,800,000,000; in 1922, $31,000,000,000; that in the seven ensuing years, the Federal Government, due to large taxes had reduced the debt by $6,000,000,000, but that now at the close of the fiscal year it was $35,000,000,000.

The cost of the present government is $15,000,000,000, one-third more than the national income at this time. He noted the great increase in the expenses of Massachusetts and in various cities of the United States. Cities all over the country have been unable to raise funds weeks and weeks at a time.

Citing figures in regard to the assistance to veterans, he said that the bill for the veterans amounted to more than that for the Army and Navy. He outlined the history of the movement for payment of the bonus, saying that it was a grave and serious matter, but it was coming before the next Congress.

Declaring that every revolution in history had been due to fiscal taxation, he predicted that if the movement were not stopped there would be disaster. The speaker quoted opinions of eminent men that conditions threatened the capitalistic system. "We have none of us devoted as much time as we should to these civic duties," he said.

The speaker noted the calibre of the members of the National Advisory Council of the League. In closing he emphasized the belief that "it is your civic duty to join the League. We ask you to help us to save the situation."

As there were no questions, it was probably evident that all had made their decision in regard to the League. President Esty announced that the Boston paper trade group had already added some 500 members to the National Economy League. The meeting then adjourned.

Those Who Attended

Those present included Chas. A. Esty, F. Bendel Tracy, J. L. Hobson, E. P. Sampson, Hubert L. Carter, Norman Harrower, Frank B. Cummings, John H. Brewer, E. L. Johnson, W. N. Stetson, Jr., Fred B. Korbel, E. L. Wood, M. A. Park, E. L. Cummings, Herbert W. Lockhart, Aaron P. Mitchell, Edw. D. Bement, W. J. McLellan, Russell S. Madden, Fred Herbolzheimer, R. L. Day, R. D. W. Ewing, Charles J. Foster, G. Sussenguth, F. H. Merrill, Frank C. Cate, Jos. A. Moses, Frank H. Winter, Frank D. Hatch, Frank Crowell, Frank A. Juckett, J. W. Vivian, W. Edwin Porter, Jr., Fred Burkhardt, T. Charles Casey, R. M. Stone, E. H. Stone, D. K. Brown, E. B. Dik, G. M. Graves, W. P. Simonds, H. C. Thayer, H. C. Upham, W. Gardner Very, Charles S. Proctor, Horace S. Proctor, Winthrop M. Crane, Jr., Irving N. Esleeck, Charles J. Brown, L. J. Parant, E. A. Hussey, Courtlandt B. Griffin, H. A. Lindenberg, V. R. Walden, C. Frederic Wellington, A. A. Tanyane, J. J. O'Brien, C. S. Clark, J. E. Swift, J. E. Swift, Jr., W. E. Chase, B. B. Stringfellow, Jr., S. C. Knobe, R. P. Teele, J. E. Roach, E. V. Hay, F. H. Blackman, A. E. Ham, Herbert C. Ham, John R. Whitney, William Ross, Arthur C. Hall, Edward H. Little, R. F. Chapin, W. K. Graves, Leon M. Poore, C. W. Townsend, William H. Tilton, H. W. Gordon, Harold A. Allen, Harold Holden, J. H. Cashman, W. H. Anders, T. K. Davis, H. C. Fowler, C. W. Fields, E. B. Sheaffer, Geo. W. Wise, Jr., T. H. Casey and F. H. Savage.

Officers of the Boston Trade Association for 1932-1933 are: President, Charles A. Esty; 1st vice president, Frank B. Cummings; 2nd vice president, F. Bendel Tracy; treasurer, Thomas H. Casey; secretary, John H. Hobson.

Glens Falls Mills Assessed

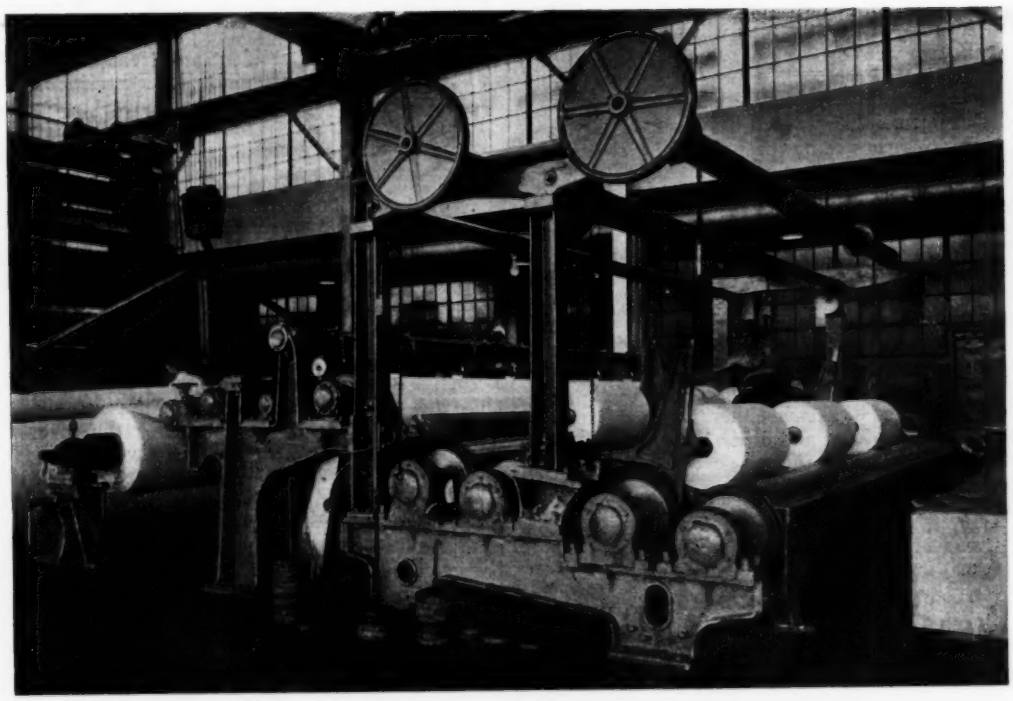
GLENS FALLS, N. Y., November 20, 1932—Paper mills of this section have been allotted certain assessments in the eighth annual installment amounting to $109,148.44 for construction of the Sacandaga Reservoir which was built under supervision of the Hudson River Regulation Board. The third annual installment for maintenance will amount to $17,385 in Warren county. Firms in this county are assessed for construction as follows:

Finch, Pruyn & Co., Glens Falls, $24,038.40; Moreau Manufacturing Company, Queensbury, $917.50; International Paper Company, $64,041.21; Warren Curtis Company, Luzerne, $588.73; International Paper Company, Luzerne, $9,381.40 and $1,452.70; New York Power and Light Company, $8,731.50.

Maintenance—Finch, Pruyn & Co., $3,930; Moreau Manufacturing Company, $150; International Paper Company, Queensbury, $10,470; International Paper Company, Luzerne, $1,533.75 and $237.50; Warren Curtis Company, $96.25.

The MOORE & WHITE Co.
PHILADELPHIA, PA.
N. PHILA. STA. PENNA. R.R.
PAPER MILL MACHINERY

HIGH SPEED FOUR-DRUM WINDER & SLITTER



MOORE & WHITE HIGH SPEED all ball bearing equipped four-drum winder & slitter with quick removable ***bottom*** slitter blades in mill of Champion Fibre Co., Canton, N. C.—236" width of drums operating at a paper speed of 2100 feet per minute.

DESCRIPTIVE CATALOGUE
UPON REQUEST

Canadian News Print Conferences Continue

Leading Executives Endeavoring to Reach Agreement Whereby Prevailing Chaotic and Destructive Conditions May be Avoided — Pooling Arrangement Providing Groundwork for Broader Understanding Nears Consummation.

[FROM OUR REGULAR CORRESPONDENT]

MONTREAL, Que., November 21, 1932—The past week has seen a continuation of the conferences of leading news print executives in Montreal with a view to arriving at an arrangement by which the industry can be freed from present chaotic and destructive conditions. Those taking part hesitate to make any public statement as to the progress of the negotiations, but the following note, published in one of the Montreal dailies, is believed to summarize the situation:

"Just as the outlook for the news print business seemed the darkest the industry is taking a new lease on life. The pooling arrangement which has been proposed at the conference going on steadily for the last two weeks appears to be nearing consummation.

"While it is not the solution for the ills which beset the news print producers, it is providing groundwork for a broader understanding. Unless unforseen difficulties are encountered, it is hoped that the plan will be put into effect within the next two weeks.

"The contribution of the various producers to a pooling plan have formed the important differences of opinion. It is reported that one company which has been the object of considerable criticism has come through with a rather gracious gesture and settled the problem."

Price Bros. Loss $429,692 in Seven Months

An interim financial and income statement on Price Bros. & Co., covering the seven months ended September, 1932, shows an operating loss after all charges (not including depreciation, depletion and sinking fund).

Income for the period amounted to $666,150. Administration and general expenses, as well as provision for the recent price reduction, pensions and discounts, brought net income down to $145,915. Against this there were interest charges of $188,398 on bank and other loans and $387,156 bond interest, making a loss for the seven months' period of $429,639.

The balance sheet shows that current assets declined from $6,664,030 to $5,985,358, while current liabilities have dropped from $6,570,774 to $6,313,118.

Substitutes Wood for Coal

Fraser Companies, Ltd., are using hardwood instead of coal in the boilers of their pulp and paper plant at Edmundston, N. B. The innovation is for the purpose of affording some measure of relief for unemployment in rural sections. The plant was originally equipped with burners to utilize the waste and shavings from the planers of the lumber plant. This equipment is available for the hardwood now being purchased.

Donnacona Paper Co. Elects

R. P. Kernan, former president of Donnacona Pulp and Paper Company, has been re-elected to that position. Shareholders recently held a meeting to discuss reorganization plans. Senator George Parent was elected vice-president and L. W. Michel secretary-treasurer.

Donnacona Paper is once more an independent unit having severed connection with Price Bros. Co. which acquired control in 1927.

Adam K. Luke Heads Paper Committee

Thirteen men prominent in the paper industry are aiding the Emergency Unemployment Relief Committee's campaign for $15,000,000 to provide unemployment relief this winter, Adam K. Luke, treasurer of the West Virginia Pulp and Paper Company, announced yesterday.

Mr. Luke, who is serving as chairman of the committee's Paper Industries Division, announced that the following men are serving on his committee: Joseph Bame, vice-president of the Commercial National Bank and Trust Company, vice-chairman; E. S. Johnson, assistant treasurer of the West Virginia Pulp and Paper Company; Charles A. Gordon, vice-president, and R. N. Hopkins, sales manager of the Oxford Paper Company; E. A. Charlton, vice-president, International Paper Company; H. E. Atterbury, president, Atterbury Brothers, Inc.; O. M. Porter, secretary-treasurer, Kraft Institute; S. C. Knode, vice-president, Albermarle Paper Company; Carlton Overton, vice-president and treasurer, Castle & Overton, Inc.; John W. Dillon, vice-president, George W. Millar and Company; Walter Stuart, president, Henry Lindemayer & Sons; Major Robert L. Gray, president, Gray Envelope Manufacturing Company; and George W. Gair, chairman of the board of Robert Gair & Co.

Duriron Co. To Make Panzl Strainer

The exclusive manufacturing and sales rights for the United States for the patented Panzl Strainer for pulp digesters is being announced by the Duriron Company, Inc., Dayton, Ohio. The strainer is being made in the form of a ring that fits between the digester body and cover, becoming a permanent attachment. Relief lines are connected directly to the strainer so that no connections have to be broken to remove the cover for loading the digester, and no openings have to be made in the digester shell or lining. Claims made for it are that the strainer cannot become clogged with chips, which is one of the hazards of the present system, loading time and labor costs are reduced, and that the positive relief makes for better results in the digester. The strainer is being made in sulphite-resisting alloy steels of low-carbon content (below .07 per cent) and will be made in other alloys if desired.

Many pulp mills in the United States and Canada are using the Panzl Strainer and report that it has proved very satisfactory and is a big improvement over the old method of running relief through the cover.

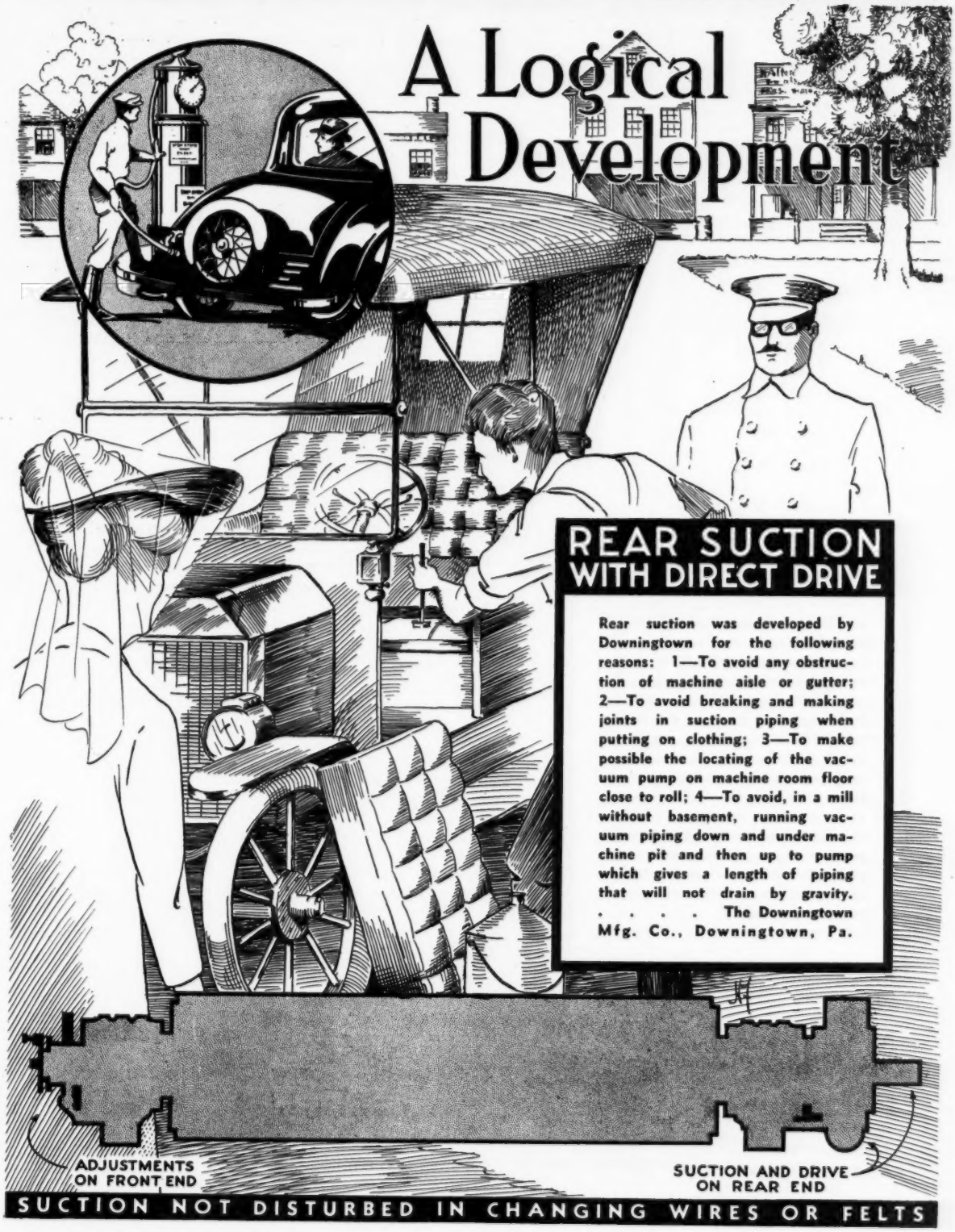
Racquette River Plant Resumes

[FROM OUR REGULAR CORRESPONDENT]

POTSDAM, N. Y., November 20, 1932—Operations were resumed this week at the sulphite mill of the Racquette River Paper Company, following a shutdown of several months. It was announced that the plant would probably operate steadily from now on if conditions in the market continued to show improvements and about thirty hands have been recalled. The mill has a capacity of 45 tons daily but it is understood that the full amount will not be produced for the next few weeks. The output is being used at the paper mill of the company near Unionville.

DOWNINGTOWN

A Logical Development



REAR SUCTION WITH DIRECT DRIVE

Rear suction was developed by Downingtown for the following reasons: 1—To avoid any obstruction of machine aisle or gutter; 2—To avoid breaking and making joints in suction piping when putting on clothing; 3—To make possible the locating of the vacuum pump on machine room floor close to roll; 4—To avoid, in a mill without basement, running vacuum piping down and under machine pit and then up to pump which gives a length of piping that will not drain by gravity. . . . . The Downingtown Mfg. Co., Downingtown, Pa.

ADJUSTMENTS ON FRONT END

SUCTION AND DRIVE ON REAR END

SUCTION NOT DISTURBED IN CHANGING WIRES OR FELTS

Obituary

Moses Hooper

[FROM OUR REGULAR CORRESPONDENT]

APPLETON, Wis., November 21, 1932—One of the most colorful figures in the water power litigation of Wisconsin over more than half a century, Moses Hooper, of Oshkosh, Wis., died at his home on November 12 at the age of 97. He had practiced law steadily until the age of 95, when his health began to fail.

Coming from Maine in 1857, he settled at Neenah, Wis., where he opened his first law office. He became attorney for the present Kimberly-Clark Corporation, and served as its counsel for more than fifty years. He also was attorney for the Green Bay and Mississippi Canal Company, which controls much of the water power in the paper mill area of the Fox River Valley, and served other paper mills as well.

Mr. Hooper became a specialist in suits involving water power and riparian disputes, and became one of the foremost authorities in the country in such legal matters. He had twenty suits before the state supreme court, considered a record.

At the age of 93, Mr. Hooper attracted nationwide attention by his appearance before the United States Supreme Court in a case which has been one of almost continuous litigation between the paper mills, power interests and owners of riparian rights along the Fox River. It involved the height of the Neenah Dam, which regulates the height of water in Lake Winnebago, from whence the water power supply is obtained during low water stages. He won his case to retain the level of the dam at a height sufficient to assure adequate water supply.

F. J. Sensenbrenner, president of the Kimberly-Clark Corporation, and Thomas W. Orbison, of the firm of Orbison & Orbison, veteran water power engineers, were among the honorary pallbearers at Mr. Hooper's funeral at Oshkosh. The body was conveyed to Milwaukee, Wis., for cremation.

Angus E. McLean

[FROM OUR REGULAR CORRESPONDENT]

MONTREAL, Que., November 17, 1932—Angus E. McLean, 41, vice-president and general manager of the Bathurst Power and Paper Company, died at Bathurst, N. B., today, after an operation for appendicitis.

Mr. McLean was the eldest son of Angus McLean, who died in January, 1931, after filling a prominent role in the industrial and financial life of Eastern Canada. He went to Bathurst in 1914 to join his father in the Bathurst Lumber Company, Ltd., and since coming here had followed the lumber and pulp and paper industries. He was associated with his father in the later-formed Bathurst Company, Ltd., the first company to manufacture news print in the Maritime Provinces. On the retirement of his father from that company shortly before his death in January of last year, the disposal of the Bathurst Company, Ltd., and the organization of the Bathurst Power and Paper Company, Ltd., the son became vice-president and general manager of the new company.

Mr. McLean leaves a widow, formerly Miss Gladys Bean, daughter of Mrs. Mary Elizabeth Bean and the late B. H. Bean, Buffalo, N. Y.; three children, Donald Bean McLean, attending St. Andrew's College, Aurora, Ont.; Mary Elizabeth McLean, a student at Netherwood School for Girls, Rothesay, N. B., and Robert McLean, at home; one brother, Red Hugh McLean, Bathurst, and three sisters, Mrs. A. Lorne C. Gilday, Mrs. R. E. Sproule and Mrs. A. A. MacNaughton, all of Montreal.

New York Trade Jottings

W. J. Pilz, secretary and manager of the Everett Pulp and Paper Company, of Everett, Wash., is a New York visitor this week.

* * *

The regular weekly luncheon and meeting of the Eastern Division of the Salesmen's Association of the Paper Industry was held at the Hotel Roosevelt, New York, on Monday last. Those present participated in a round table discussion of current business conditions.

* * *

R. S. Kellogg, secretary of the News Print Service Bureau, New York, and Mrs. Kellogg, have just returned from an enjoyable sea trip to Savannah, Georgia. Mr. Kellogg spent several days inspecting the Division of Pulp and Paper Research of the Georgia Department of Forestry and Geological Development, which is in charge of the well known industrial consultant, Dr. Charles H. Herty. He also inspected the timber growing section of the state.

* * *

Joseph L. Fearing, president of the International Paper Sales Company, has again accepted the chairmanship of the annual appeal for the United Hospital Fund of New York. Last year the paper industry contributed $2,648 to the Fund for distribution to its 55 member hospitals on the basis of the free service which they rendered. According to Mr. Fearing the financial situation of many of the hospitals is very serious and he hopes that the men engaged in the paper industry will be unusually well represented among the contributors this year.

* * *

The bondholders' protective committee for Abitibi Power and Paper Company 5 per cent first mortgage bonds, series A, due 1953, has advised the New York Stock Exchange that a majority of the $48,267,000 principal amount of such bonds outstanding has been deposited. The protective committee further announced that should the Exchange, in accordance with its ruling concerning matured bonds, remove these bonds from the list, immediate action will be taken by the committee to have listed the certificates of deposit issued by the depositaries.

* * *

There was a large and enthusiastic gathering of members and guests present at the annual dinner of the Paperboard Industries Association, which was held at the Hotel Commodore, New York, on Wednesday, November 16. Henry D. Schmidt, of the Schmidt & Ault Paper Company, York, Pa., president of the association, was an efficient toastmaster. Following the banquet inspiring and instructive addresses were given by several of the past presidents of the organization and other members. A spirit of optimism prevailed throughout the event which augurs well for the future success of the industry.

Waste Paper Dealers to Confer

The Waste Paper Institute, with executive offices at 1109 Times Building, New York, has been holding a series of conferences both with dealers and consumers in the hopes of inducing the board manufacturers to adopt buying policies which can have the wholehearted support of the Institute and the industry at large. In this connection an important conference of dealers has been called for Friday, November 25 at 2 P.M. at the executive offices of the Waste Paper Institute, 1109 Times Building, New York. This particular conference will be thrown open to all waste paper dealers operating in Eastern Territory, whether members of the Institute or not.

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PAPER EXPORTS LOWER

Exports of paper and paper products from the United States in September were valued at $1,118,852, contrasted with $1,168,649 in the preceding month and $1,683,730 in the corresponding month last year according to the Paper Division of the Department of Commerce. Wall paper exports more than trebled the extremely low figure of August, but showed a decrease of 56 per cent over September, 1931. Other increases over August were as follows: Coated papers, 60 per cent; bristols and bristol boards and sheathing and building papers, each 30 per cent; toilet paper, 27 per cent; overissue and old newspapers, 18 per cent and paper towels and napkins and fiber insulating lath or board, each approximately 15 per cent, while slight increases occurred in other paper board, blotting paper, paper bags, boxes and cartons and envelopes.

Box board suffered the heaviest decrease, amounting to only $25,756, or less than half of the record made in August. Other significant losses compared with August figures were as follows: Cash register and adding machine paper, 40 per cent; filing folders, index cards, and other office forms, 35 per cent; book paper, 30 per cent; news print, greaseproof and waterproof papers and papeteries (fancy writing paper), each approximately 25 per cent; wrapping paper, vulcanized fiber sheets, strips, rods and tubes and tissue and crepe paper, each approximately 20 per cent; and cover paper, 15 per cent, while there were only slight decreases in wall board of paper or pulp and other writing paper.

Compared with a year ago, surface coated papers, with a valuation of $54,989, registered an increase of 25 per cent and tissue and crepe papers showed a slight increase. with these exceptions, all other outgoing shipments of paper and paper products in September had a considerably lower valuation than in the same month last year, book paper, not coated, with a decrease of 67 per cent suffering the most and being closely paralleled by cover paper, which lost out by 60 per cent.

Other shrinkages were as follows: Vulcanized, fiber sheets, strips, rods and tubes, and wall board of paper or pulp, each 50 per cent; toilet paper, paper towels and napkins, other paper board, envelopes and sheathing and building paper, and papeteries, each approximately 40 per cent; paper bags, 45 per cent, wrapping paper and box board, and fiber insulating lath or board, each 35 per cent; blotting paper, other writing paper, each 30 per cent; greaseproof and waterproof paper, 27 per cent; filing folders, index cards and other office forms, 23 per cent, bristols and bristol board, overissue and old newspapers, and news print, each 20 per cent.

September exports of paper base stocks were valued at $197,617, representing a 38 per cent decrease compared with those of a year ago, but an increase of $78,658 over those of August. Pulpwood exports were extremely low, amounting to only $2,164, against $35,111 a year ago and $5,045 in the preceding month. Exports of sulphite wood pulp were valued at $140,118, an increase of 70 per cent over August, but a considerable decrease over September, 1931, while those of soda wood pulp were valued at $8,273, against $1,980 a year ago and showing an increase of 65 per cent over August. Exports of rags and other paper stock showed an increase of 45 per cent over August, but were considerably lower than a year ago.

Imports of paper and paper products in September amounted to $6,996,141, representing decreases of 10 per cent and 25 per cent, respectively, over the preceding month and the corresponding month last year. News print imports were valued at $6,322,677, a 10 per cent decrease over the preceding month and a 25 per cent decrease over those of a year ago. Imports of cigarette paper, books and covers were high, amounting to $280,378, they registered an increase of 33 per cent over the same month last year and a 7 per cent increase over August. Heavy increases over August exports occurred in other wrapping paper, pulp board in rolls, leatherboard, testboard and wallboard, paper board, pulpboard and cardboard, and wall paper, while heavy decreases took place in kraft wrapping paper, writing and drawing paper, uncoated paper, decorated or embossed and papier-mache and pulp manufactures.

September imports of paper base stocks were valued at $3,910,652, a slight increase over August, but a 48 per cent decrease over September, 1931. Rossed spruce imports, which a year ago amounted to $69,616, were practically nil. Imports of peeled spruce were valued at $641,745, approximately 5 per cent higher than in August but a decrease of 50 per cent when placed beside the fig-

ures of a year ago. Rough spruce imports showed a heavy decrease, both when compared with August and with the corresponding month last year. Imports of unbleached ground wood pulp were more than double those of August, but compared with a year ago there was a 23 per cent decrease, while those of bleached ground wood pulp showed increases of 75 per cent and 20 per cent, respectively, over the preceding month, and the same month last year. Bleached sulphite wood pulp imports were valued at $1,013,431, a 37 per cent decrease over September, 1931, but only a slight decrease from the previous month, and those of unbleached sulphite pulp showed an increase of 6 per cent over August and a 48 per cent decrease of a year ago. Unbleached sulphate pulp incoming shipments showed an increase of 15 per cent compared with August, but a decrease of 53 per cent over those of a year ago, while bleached sulphate registered gains of 10 per cent and 46 per cent by a like comparison. Imports of soda pulp were valued at $3,234, an increase of 10 per cent over the previous month, but a 76 per cent decrease over September, 1931, and rags for paper stock, with a valuation of $63,617, showed a decrease of 35 per cent both from those of a year ago and from those of August.

Share the Work Dinner

Over 500 industrialists, bankers, business men and representative leaders in other lines met at dinner Monday evening of this week at the Waldorf-Astoria in support of the Share the Work Movement which seeks to spread jobs. The dinner was arranged by Alfred P. Sloan, Jr., chairman of the Second Federal Reserve district, who was toastmaster.

The object is to find jobs for 1,000,000 to 2,000,000 unemployed by spreading available employment opportunities through reduction of hours of labor. The idea behind the movement is to prevail upon employers to reduce the hours of labor through cooperation with their employees so as to make possible the employment of additional workers. More than 3,500 companies throughout the nation already have put the idea into effect.

Those who attended the dinner included leaders of business and industry who have put the idea into practice. They assembled to attest their approval of the movement and bring their influence to bear upon other employers to follow their example.

Inspiring addresses in support of the work were made by Owen D. Young, chairman of the Board of the General Electric Company; Mayor McKee, Walter C. Teagle, president of the Standard Oil Company of New Jersey and National chairman of Share the Work Movement; Harvey D. Gibson, chairman of the Emergency Relief Committee, Thomas J. Watson, president of the Merchants Association of New York and New York Regional chairman of the Share the Work Movement, and others.

President Hoover sent the following telegram: "I have noted with deep satisfaction the encouraging growth of the Share the Work Movement under your able leadership and growing out of our conferences in Washington. You and your chairman deserve and are receiving the appreciation of the whole nation for your untiring efforts towards the common good. This movement affords one of the most practicable methods of speedily relieving the present distressing unemployment situation and should have the active cooperation of every employer and employee. Already a strong sense of job-security has been imparted to the employees of all firms which have adopted share-work practices. We need to make this security nation wide, reaching every person who now has a job. Only in this way can purchasing power be made confident and effective in speeding business recovery. For this reason I am anxious to be kept periodically informed as to the progress of your organization in widening the scope and increasing the celerity of action in this vitally necessary undertaking. The need for greater effort is more urgent than ever and to this end my fullest cooperation is at your command."

President-elect Roosevelt sent the following message: "Of course this work must go on—and go on with redoubled vigor during the coming winter. It is not enough to get the big nation-wide industrial organizations to put the share—the work plan into operation; it is equally important to get the smaller corporations and smaller employers in every community to put work sharing into their industrial plants and businesses. Labor is for this important movement—and so is business. I consider it an essential in the continuing emergency, and I call for cooperation to put it into effect everywhere."

The speeches of Mayor McKee and Mr. Teagle were broadcast over WEAF and a national chain work through the courtesy of the National Broadcasting Company.

News Print Curtailment Fails

[FROM OUR REGULAR CORRESPONDENT]

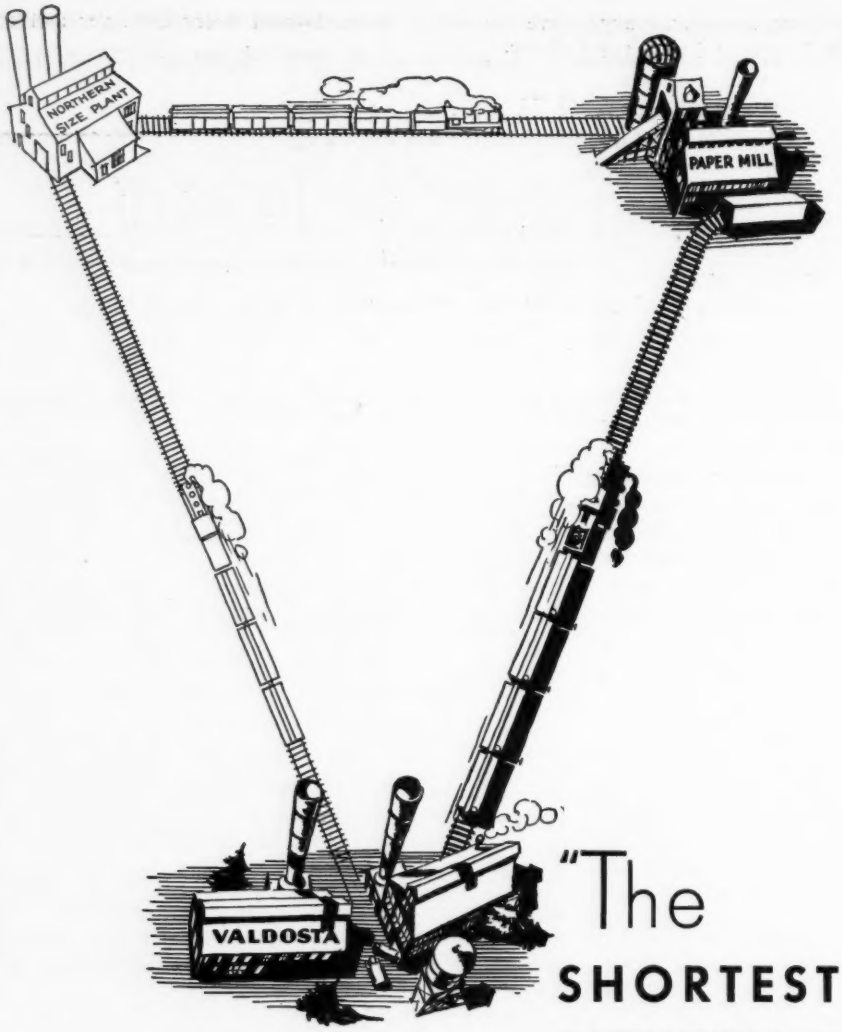
WASHINGTON, D. C., November 23, 1932—Recent attempts towards an organized curtailment of news print production in the three northern European countries seem to have failed following Finland's refusal to join the union, according to a report from Commercial Attache Lund, at Oslo.

The Finnish news print industry enjoys an unusually strong position in both pulp and paper today, due to low cost of production, and evidently prefers to run at full capacity at low prices rather than curtail production in the hope of better prices. It is generally conceded in Norway, and possibly in Sweden also, that Finnish news print mills can be run at a profit with prices that mean certain loss in the other two countries. Pulpwood prices give the Finnish mills a tremendous advantage over Norwegian, and to a lesser degree Swedish, mills. Reports have recently been current that pulpwood is being delivered to Finnish mills at a price of $1.00 to $1.10 per cubic meter, while in Norway wood from last season's cut is costing the mills approximately $1.75 per cubic meter. Wages in Norway are also much higher, due not only to the fact that Finnish mills employ a larger proportion of women but that wages paid male labor is much lower.

Luzerne Mill To Be Auctioned

There will be sold at auction on Thursday, December 1, at Hadley, Saratoga County, N. Y., the entire equipment of the mill of the Luzerne Paper Company, by order of the Adirondack Realty Holding Corporation, which is a subsidiary of the New York Power & Light Corporation, of Albany, N. Y., the latter being a part of the power interests known as the United Corporation.

This Auction Sale is being held under the direction of Messrs. Gibbs-Brower Company, Inc., of New York City, and is to be an absolute disposal sale of all equipment used in this mill including a five cylinder 102 inch board machine and a 78 inch Rice Barton & Fales Inc. Harper Fourdrinier, as well as beaters, Jordans, pumps, etc.



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Section of the
Technical Association of the Pulp and Paper Industry
Edited by Ronald G. Macdonald, Secretary

Pulp and Paper Industry Literature Review

Abstracts of Articles and Patents Compiled by the Abstracts and Bibliography Committee of the Technical Association of the Pulp and Paper Industry, A. Papineau-Couture, John F. Ohlson, C. E. Peterson and Clarence J. West, Chairman

The National Research Council, 21st and B Street, Washington, D. C., through Dr. Clarence J. West, extends the courtesy of its photostat service to members of the Technical Association of the Pulp and Paper Industry. Owing to a limitation of personnel and time, this service cannot be extended to non-members.

The charge for the photostat service is: 9 x 11 inches—18 cents per page, 18 x 11 inches—35 cents per page, 22 x 18 inches—70 cents per page, minimum charge, 50 cents.

Payment should be made upon receipt of invoice.

Copies of United States Patents can be obtained from the United States Patent Office, Washington, D. C., for 10 cents each. Send currency, not stamps.

Cellulose and Lignin

The Volume Relations of the System Cellulose and Water. Edgar Filby and O. Maass. Can. J. Research 7, 162-177 (Aug. 1932).—The absolute specific volume of cellulose was determined by means of helium gas by a newly developed procedure which is claimed to be more accurate than any previously used where a small quantity of porous material is involved. The specific volume of cellulose in helium is 0.640±0.001 cc. The volume of the system cellulose-water vapor is much smaller than that given by the component cellulose and condensed water as long as the amount of absorbed water is below 4%; with more than 8% water, the density of subsequently absorbed water is the same as that of the normal liquid. —A. P.-C.

The Hydrolysis of Lignin with 12% Hydrochloric Acid. Max Phillips and M. J. Goss. J. Am. Chem. Soc. 54, 3374-3377 (Aug. 1932).—Lignin isolated from corn cobs, oat hulls and spruce wood by the method of Willstätter and Zechmeister, by the alcoholic and aqueous sodium hydroxide methods and by Freudenberg's modification of Urban's method, was distilled with 12% hydrochloric acid. Formaldehyde was obtained in appreciable quantity only in the distillate from the lignin isolated from oat hulls by the Freudenberg and Harder modification of Urban's method, and in the distillate of the lignin from spruce wood prepared by the same method. The result, as regards spruce lignin, agrees with that of Freudenberg and Harder.—A. P.-C.

Lignosulphonic acid. Peter Klason. Ber. 65, no. 4: 625-628 (Apr. 6, 1932); Svensk Pappers-Tidn. 35:16-21 (1932); Svensk Kem Tid. 44: 85-89 (1932); C. A. 26:3109.—Klason discusses previous investigations on the constitution of the lignosulphonic acids and concludes that Alpha-lignosulphonic acid has a distinct aldehyde character and that beta-lignosulphonic acid probably has several free phenol groups.—C. J. W.

The catalytic effect of solid lignosulphonic acid. Erik Hägglund and T. Johnson. Biochem. Z. 250:321-325 (July 19, 1932).—The authors believe that the hydrogen ion concentration of the cooking liquor affects the velocity of the cooking process. Also, the process is one of hydrolysis and it is thought that lignosulphonic acid in the solid phase catalyzes the hydrolysis. A number of cane sugar inversion experiments were carried out, using lignosulphonic acid instead of a mineral acid. It was found that inversion took place, in spite of the insolubility of the lignosulphonic acid. This indicates some kind of catalytic action. The degree of dissociation was about 40 per cent. —C. J. W.

The "reserve" lignin in spruce wood. Svensk Pappers-Tidn. 35, no. 5:152, 155 (Mar. 15, 1932); Bull. Inst. Paper Chem. 2:265.—Klason designates the methyl alcohol insoluble part of lignin (about 29.3 per cent of the weight of the wood) as "reserve" lignin. The same is to be found as a dark rim between the annual rings and as the edge of the new ring which starts in spring, in the lower half of the annual rings of branches and twigs, which have to carry not only their own weight but also the weight of the snow deposited on them in winter, etc.—C. J. W.

Liberation of ligninsulphonic acid from sulphited pulp. C. Kullgren, Svensk Kem. Tid. 44, no. 1:15-23 (Jan., 1932); C. A. 26:4948.—The permutite-like properties of ligninsulphonic acid were applied to its determination in sulphite pulp. The pulp was washed with water followed by 0.2 normal hydrochloric acid to remove metallic ions and ethyl alcohol to remove resins; the final material was extracted with various concentrations of hydrochloric or sulphuric acid alone or in presence of sodium chloride or sodium sulphate at 78°, the amount of acid extracted and the acid value and methoxyl content of the residue being determined. Extraction with ethyl alcohol effected a partial esterification of the carboxyl group but no sulfonic acid groups. The extracted sulphonic acid was obtained as a partly crystalline residue on evaporating the extraction liquors. It did not reduce Fehling solution, either before or after hydrolysis and was optically inactive.

The acid extracted by water, approximately $C_{26}H_{32}O_{13}S$, contained 2 methoxyl groups, while that extracted by methyl alcohol had a higher percentage of methoxyl. Moderate heating gave a black modification soluble in water, a phenomenon not so prominent with the sodium salt. The acid gave positive fuchsin and phloroglucinol tests and a violet fluorescence in ultra-violet light.—C. J. W.

Alkaline Processes

Drying of Sulphate Chips. O. Nordstrom. Svensk Pappers-Tidn. 35, no. 5:161-162, 165-166; no. 6:192, 197-198, 201 (Mar. 15, 31, 1932); Bull. Inst. Paper Chem. 2:267.—A detailed description of the latest installation of Nordstrom's drying tower for chips at Wifstavarf, Sweden. The drying is accomplished by passing the gas from the sulphate recovery furnaces through the chips in the tower. The first installation of this type was made in 1926 at Camas, Washington, in the sulphate mill of the Crown Willamette Paper Co.—C. J. W.

Causticizing of Sulphate Liquor. Th. Overwien. Papir-J. 19, no. 22:244-248, 259-262 (Dec. 23, 31, 1931); Bull. Inst. Paper Chem. 2:234.—The sulphate process employs caustic soda solutions containing sodium sulphide, the latter exerting a certain influence upon the causticizing process. The main object of the present investigation was to study the influence of the sodium sulphide. In addition, a number of experiments and calculations are given for determining the liquor composition and lime quantity, which will give the most economic result in a sulphate mill.—C. J. W.

Safety devices in Sulphate Pulp Mills. Svensk Pappers-Tidn. 35:132-134 (1932); C. A. 26:3107.—Twenty safety devices and precautions drawn up by the Royal Social Service to obviate poisoning, fire and explosion.—C. J. W.

Paper from Straw by the Chlorine Process. Umberto Pomilio. Ind. Eng. Chem. 24, 1006-1010 (Sept., 1932); Chimie & Industrie 28, 255-262 (Aug., 1932).—A discussion of the Cataldi-Pomilio chlorine-gas process of pulping materials such as straws, juts, cornstalks, etc., with a description of the recently completed plant near Rosario, Argentina.—A. P.-C.

Lake States TAPPI Discuss Equipments

The regular monthly meeting of the Lakes States Section of the Technical Association of the Pulp and Paper Industry was held on November 15, at the Conway Hotel, Appleton, Wis. The meeting was in charge of Chairman R. LeRoux of the Interlake Pulp and Paper Company.

Ben. Larrabee, member of the executive committee of TAPPI and former president of the Superintendents Association was present and delivered a short address. He stressed the need of cooperation among the members of TAPPI and between the affiliated associations. An invitation was extended to visit the West Coast.

Pulp Testing Equipment

The first address of the evening was given by Paul Boronow of the Valley Iron Works Company, Appleton, Wis. on "The Design and Care of Pulp Strength Testing Equipment." He pointed out that as manufacturers of testing equipment his company had noted and followed some of the opinions and suggestions of its customers in changing the design of equipment but found that what one party recommended might not be accepted by others or might prove to be too expensive. As a result the improvements have been along conservative lines.

Repeated tests using this equipment have indicated checks accurate to $\pm$ 2.0 per cent. Typical testing conditions were outlined. The beater with its improvements was described in detail, the necessity of cleaning out stock from the annular space around the bed plate and diaphragm was emphasized. The process of grinding in the bed plate and roll was described in detail. The sheet mold, hydraulic press and drying equipment were also described. For rapid testing and drying of paper samples a drying oven was developed.

Speed Reducers

The second paper of the evening was presented by James A. Porter of the W. A. Jones Foundry and Machine Company, Chicago, Ill. This paper was entitled, "Speed Reducers in the Pulp and Paper Industry." It was pointed out that there were a great many types and variations of this class of machinery including spur, straight bevel, single helical, double helical or herringbone gear, worm, spiral bevel and hypoid gears, also the chain and sprocket drives, together with the V-belt and plain flat means of reducing or increasing speed. The problem of selecting the drive is very complicated and made difficult by the fact that a great many claims for superiority are advanced for this kind of machinery which are not distinctive to any one type but are common to every speed reducer of the enclosed class having the gears running in a bath of oil or lubricated by means of a pump.

A perfect speed reducer was described as one which must be reliable, moderate in cost, efficient over a large range of speed ratios, temperature conditions, load demands and revolutions per minute, possess a long life, compactness in floor space, quietness in operation, possess the quality of transmitting power in a perfectly even manner and be free from shock and vibration. In order, he then described, in full, the spur gear unit, the herringbone gear unit, the worm gear unit, and finally the spiral bevel and hypoid gears. He pointed out the advantages, as well as the disadvantages, of the above units. The major points to be considered in selecting the type of speed reducer were enumerated. Briefly, they were as follows: floor space, load requirements, and ratio of reduction. The paper was closed with an approximate tabulation showing the relative costs of spur, worm and herringbone reducers with any gear ratio from 3 to 1 up to 70 to 1. The paper was supplemented with lantern slides.

TAPPI Notes

John S. Bates, chief chemist of Price Brothers & Co., Ltd., Quebec, P. Q. will sail from Quebec on November 26 to take up a new position as technical director of Price & Pierce, Ltd., 27 Clements Lane, London, E.C. 4, England.

Chester C. Irving who was for the past eleven years superintendent of coating and finishing for the Falulah Paper Company is no longer with that company and may be reached at 114 Pleasant Street, Fitchburg, Mass.

P. Fredrik Gross, formerly student at the Institute of Paper Chemistry, Appleton, Wis., is now a student in the graduate school of Cornell University.

Douglass E. Murray formerly with the Flintkote Company, is now chemist of the Bogota Board Company, Bogota, N. J.

The Relative Stabilities of Rag and Purified Sulphite Pulps*

By Harry F. Lewis[1]

Summary

The chemical stabilities of selected rag and highly purified wood pulps toward a variety of agencies of degradation have been intensively investigated.

The pulps employed have included the best grade of rag stock as made from new unbleached cotton cuttings, No. 1 muslin, a fairly good grade of rag stock produced from new blue denim cuttings and bleached to a good color, blue overalls—one from old, bleached white and colored rags, thirds and blues—and two highly purified sulphite pulps known as Alpha and Super Alpha respectively. These were all commercial samples picked more or less at random, over a considerable period of time, in various mills both in the east and middle west.

The degradation agencies studied have included heat in combination with air, nitrogen and oxygen, alkaline solutions in combination with air, nitrogen and oxygen, acid solutions and light from two sources: The carbon arc Fadeometer and the Cooper-Hewitt quartz mercury lamp.

Degradation has been followed by determinations of the chemical constants at various temperatures and times. The constants used for indicating chemical degradation have included the α-cellulose content and the copper number. Other determinations less generally used are the volumetric determinations of β- and γ-cellulose and pentosans. Colloidal changes have been followed by measurements of the cuprammonium viscosities. As is pointed out, these tests indicate directions and tendencies rather than furnish an exact estimation of an amount of a chemical individual.

Emphasis should be laid upon the fact that the colloidal structure of a stock as measured by its cuprammonium viscosity is a relative measure of the inherent strength of a stock. Chemical stability is related, on the other hand, to the content of α-cellulose present in the stock. As a rule, stocks of high α-cellulose content have low copper numbers; such stocks as these are more resistant to the degrading action of the reagents thus far investigated. A stock of highly stable colloidal structure always has high chemical stability; on the other hand, a stock of high chemical stability does not of necessity have the colloidal structure of highest stability.

Work is being continued on the action of both visible and ultra violet light and of oxidizing agents, et cetera. Other physical measurements than viscosity are being made on the degraded pulps. An extensive investigation is also being carried on to determine what is the relation between the viscosity of a pulp and such strength characteristics as double folds, tear, Mullen and tensile strength when both the conditions of beating and sheet formation are carefully controlled and paper testing done under accurately controlled temperature and humidity conditions.

Preface

The work herewith reported represents a study of the relative stabilities of rag and purified sulphite pulps, which has been undertaken by the Institute of Paper Chemistry upon a strictly impartial scientific basis. The purified sulphite pulps were samples of Alpha pulps purchased for mill use, withdrawn from regular mill supplies, and approved by a committee all of whom are users of Alpha pulp. Similarly, rag stocks were drawn from mill supplies and approved by a committee all of whose members use both rag stock and Alpha pulp.

With materials thus supplied, the staff of the Institute of Paper Chemistry has occupied itself for a period of a year and a half making analyses and preparing the way for deductions. The progress of the study has been fruitful of many suggestive indices, and I am today presenting a summary of the data which have been gathered and an indication of some of the tentative findings towards which we have been moving. Definite conclusions must inevitably wait upon the acquisition of further data and the development of still other techniques.

We shall welcome corrections of the data, improvements in our techniques, and revisions of our tentative findings because the interests of the Institute of Paper Chemistry being exclusively scientific, it is their purpose and desire to arrive at a thoroughly non-partisan and detached conclusion.

It is our purpose in presenting these facts not to enter into any partisan controversy but merely to contribute to the general fund of knowledge bearing upon the investigation of this particular subject and to work toward a consensus of opinion.

The Statement of the Problem

The questions involved in a determination of absolute permanence characteristics of a pulp or paper lead to empirical discussions to which there is no positive answer. The only final and absolute test of the lasting qualities of a sheet of paper is age.

Since we cannot wait on time to tell which stock and what furnish will give a sheet best fitted to withstand the degrading factors of natural ageing and use, we must attempt to isolate those factors which produce the degradation over the period of time. We must then seek artificially to intensify and hasten these or similar actions, so as to be able to draw sound conclusions as to the manner in which various stocks withstand degrading influences.

One constituent in the sheet of fundamental importance in connection with the permanence characteristics of the sheet is the pulp stock used in the furnish. Stock of low stability when treated artificially with various reagents will, in all probability, form a sheet less able to withstand the degrading influences of normal ageing, all other things being equal, than a sheet made from stock of high stability toward those various reagents.

Unfortunately, there is no one relative measure of the stability of a stock which is entirely satisfactory. No one analytical value serves to measure all the various physical and chemical changes taking place in cellulose under the varied conditions of natural degradation. No one degrading influence or accelerated ageing test can be expected to simulate all of the natural ageing factors, for stocks may be degraded by the action of acid vapors in the air, by heat,

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Contribution of the TAPPI Fundamental Research Committee.

[1] Member TAPPI, professor of organic chemistry, Institute of Paper Chemistry, Appleton, Wis.

by the action of visible or invisible light rays under certain conditions, by the electric discharge, by the action of non-cellulosic materials, by traces of metals or metallic oxides present in the sheet as impurities, and probably by many other agencies. Reactions conducive to the greatest degradation may not even be present; for example, photochemical effects are missing in a stock aged by the usual oven-aging test. Nor will one accelerated artificial ageing test accelerate all the normally occurring degradation reactions at the same rate.

In spite of the difficulties involved in accelerating natural ageing processes, it is still possible to gather certain indirect evidence of the relative changes which must occur when pulps are subjected to treatment with acid solutions, alkaline solutions of various types, oxidizing solutions; other samples may be heated, others exposed to the action of light of known characteristics. Certain changes which result from these various treatments may be measured by analyzing the stocks for loss in α-cellulose content, or for pentosan content, copper number, or other approximate measures of chemical structure. Alterations in physical structures are indicated by measurements of viscosity, swelling and of probable variations in zeta-potentials as a consequence of ageing influences.

By carrying out these studies with standard pulps, truly representative of the various types of rag and purified sulphite pulps, it becomes possible to establish which stocks of those investigated are most resistant to change by the largest number of agencies bringing about the physical and chemical degradation of pulp stocks. These should then be the most resistant to natural ageing conditions, other things being equal, and should provide paper best adapted to endure for long periods of time.

Comparative studies of this type are being carried out with three different grades of rag stocks and with two highly purified wood pulps. This report is the first of a series describing that work.

The Structure of Cellulose

Before taking up the details of the investigation, it may be worthwhile to review briefly the latest concepts in regard to the nature of cellulose. For purposes of definition, an "ideal cellulose" may be considered as consisting of long polymeric chains of amylene-oxide anhydroglucose rings, whose structural units are held together by means of acetal linkages between the No. 1-carbon of the one ring and the No. 4-carbon of the next ring. The second ether bridge of the acetal linkages are probably of the ring closure. These acetal linkages are probably of the β-glucoside type; hence, the cellulose chain very likely has the following structural formula:

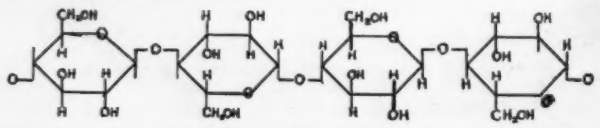


FIG. 1
Cellulose chain molecule.

Such a chain may have a length of 5000 A, and a diameter of from 7 to 10 A, according to Staudinger.[2]

The actual order and arrangement of these chain molecules is the subject of a dispute between Meyer and Mark [3] and their followers on the one hand, and Staudinger [2] on the other. Meyer and Mark, through extensive X-ray investigations, believe that the physical unit of structure of the native cellulose is the micelle; in this micelle, many long thread-like molecules are held together in ordered arrangement in a direction parallel to their long axes by the secondary valences of their many hydroxyl groups. Staudinger favors the idea of long chain molecules combined in the solid form in some type of a crystal lattice.

It is not within the province of this paper to discuss in any detail the evidence which seems to favor one concept or the other. It should be pointed out that in either case the old picture of a molecule as an entity of unchanging weight and size does not hold with polymers like cellulose.[4] Molecular sizes here are average. Long chains and short chains are mixed and any possible molecular weight value would represent only an average figure of all the chains present.

Pulps of the types of rag and purified sulphite stocks vary from the "ideal cellulose" in a number of regards. They have been more or less degraded in the process of purification and, hence, will be of differing average chain lengths. Those most degraded in their preparation will have a greater number of chains of shorter length. Sugar units other than the amylene-oxide form of glucose may be present as structural units in the chains; these may include other hexose sugars such as galactose, or mannose, or pentose sugars like xylose. Many authorities consider that glucuronic acid is occasionally present in the chain as a product of the oxidation of glucose units. A hypothetical chain containing both pentose and glucuronic acid units in addition to the typical glucose units is illustrated in Fig. 2.

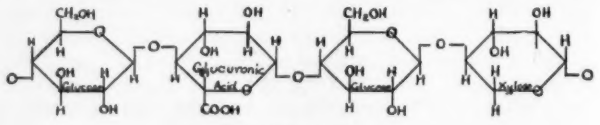


FIG. 2
Modified cellulose molecule.

In spite of the confusion existing, there seems to be little disposition to question the existence of these polymeric chain molecules; the crystalline nature of these in the solid state is likewise well established. We might consider the condition existing in the solid form of cellulose as being related to two types of polymerization. The first, chemical polymerization, is responsible for the chain molecules. The second, or physical polymerization, results in the formation of the crystallite or micelle.

Keeping this picture of the structure of cellulose in mind, it is possible to classify cellulose reactions according to reactions affecting primary valence linkages on the one hand, and secondary valence linkages or association forces on the other. In certain of the reactions of cellulose, both types of change appear to occur. Without doubt however, under certain conditions the secondary valences are first attacked, resulting in a physical depolymerization, to be followed by reactions involving the primary valences. In at least one type of cellulose reaction, the primary valences seem to be attacked without any widespread change in the micelle. The first is termed by J. R. Katz[5] a permutoid reaction, the second a micellar surface reaction.

As a rule, the inter-micellar reactions are the first to take place. These may result merely in a reversible swelling or in an irreversible depolymerization with a decrease in the micelle size. Such changes relate to the secondary valences or association forces. Coincidentally or shortly thereafter, chemical reactions occur. These, in turn, may be either of two types. In one, acetal linkages joining the anhydroglucose units are hydrolized; the length of the

[2] Staudinger, H. and Schweitzer, O. Ber. 63; 3132-54 (1930).
[3] Meyer, K. H. and Mark, H. "Der Aufbau der hochpolymeren organischen Naturstoffe", Chapter V, Akademische Verlags. Leipzig, 1930.
[4] For a good summary of the properties of polymers, see: Carothers, W. H. Chem. Reviews VIII; 353-426 (1931).
[5] Katz, J. R. Erg. Exakt. Naturw. 3; 316 (1924) and 4; 154 (1925). Also reference 1; 122-9.

cellulose chains are profoundly altered and chemical depolymerization results. The other brings about modification in the active groups of the anhydroglucose unit, without greatly affecting the length of the chain. Solubility of the cellulose in aqueous solvents increases as chemical changes of this first type occur; ultimately, the whole mass is completely converted to soluble lower polysaccharides, glucose and reversion products. With chemical changes of the second type, on the other hand, solubility in aqueous solvents increases much more slowly. Micellar degradation, in most cases, seems to be generally followed by chemical depolymerization due to hydrolysis. On the other hand, certain reagents, incapable of splitting the acetal linkage, only slowly modify the micellar complexity, although they may bring about chemical reactions of the second type.

The data to be presented in the following pages are suggestive of the manner in which the various reagents attack cellulose. These may be summarized very briefly by stating that in the early stages of the degradation of cellulose by heat, certain forms of light, acids, and oxidizing agents, a micellar degradation occurs which is rapidly followed by chemical depolymerization. Alkaline solutions, on the other hand, modify the physical structure of the cellulose by swelling, without greatly altering the length and number of chains making up the micelle. The action of such solutions on "ideal cellulose" is partly peptization of the more easily peptizable chains and partly oxidation and condensation, whereby the sodium salts of volatile organic acids are slowly formed and go into solution. In the main, the alkaline solutions attack the impurities of the cellulose much faster than they attack the cellulose fraction.

The above generalizations hold either for rag pulps or for the highly purified sulphite pulps, the difference between the two being largely one of degree. This latter is due, in part, to the particular polymerized non-anhydroglucose units present in the sulphite pulps and, in part, to a difference in the physical and chemical stability of the cellulose fraction.

These highly purified wood pulps of the type of Alpha and Super Alpha pulp differ structurally from the rag pulps in that they contain as much as 5 per cent of pentosan material. This would seem to be at least partly present as an integral portion of the cellulose chain molecule, or it would have been extracted in the processes associated with the purification of the original sulphite pulp. Of this pentosan, more than half has been isolated as xylan. A very small amount of galactose appears to be present in the purified wood pulp. Not more than .7 per cent of pentosan material, on the other hand, is present in rag pulp. Both the purified wood pulps and the rag pulps contain small amounts of glucuronic acids; rag pulps, on analysis, show from 0 to .5 per cent, and the Alpha pulps somewhat greater amounts. The Alpha pulps contain from 90 to 92 per cent of resistant or α-cellulose; the other 8 to 10 per cent is dissolved by 17.5 per cent NaOH in a half hour at 20°. The rag pulps studied run from 96.5 per cent to 98 per cent α-cellulose. Rag pulps, consequently, are much more closely related to the "ideal cellulose" previously described than are the purified wood pulps. These observations indicate that the conclusions reached by Mahood and Cable[6] in regard to the differences between cotton and wood celluloses hold for the cellulose in rag stock and the Alpha pulps.

From the standpoint of the colloidal structure as indicated by the viscosity of the cellulose-cuprammonium solutions, carefully bleached rag pulps from new unbleached rags are superior both to the two other rag stocks and also to the purified sulphite pulps. The ordinary blue overalls stocks have about the same viscosity as the Alpha pulps, while that of the thirds and blues is somewhat lower. Since the viscosity of the pulps is closely related to the inherent strength of the pulp, new muslin stock is fundamentally stronger than either the other rag stocks or the purified wood pulps.

[6] Mahood, S. A. and Cable, D. E. Ind. Eng. Chem. 14; 727 (1922).

Experimental Methods

This paper presents the data obtained in a study of the relative stability of three rag pulps and two purified sulphite pulps against degradation by heat, the action of alkaline solutions, the action of acid solutions, and the action of light. The pulps have been exposed to the action of the various agents for varying periods of time under controlled conditions. Changes in α-, β- and γ-cellulose, copper number, and cuprammonium viscosity in the various series have been followed.

The five stocks studied included a bleached rag stock prepared from new unbleachel muslin rags known as No. 1 muslin, a bleached rag stock from new blue denim clippings, blue overalls, a bleached rag stock from old bleached rags, thirds and blues, and two purified sulphite pulps—Alpha pulp and Super Alpha pulp. These five stocks have been obtained directly from commercial stocks in a number of mills; their analyses showed them to be representative of the materials being supplied and used commercially.

The following analytical methods have been employed:

1. CUPRAMMONIUM VISCOSITY.

Tentative Official Standard Method of the Technical Association of the Pulp and Paper Industry: Technical Association Papers, Series XV; 217 (June, 1932).

2. α-CELLULOSE.

The α-cellulose content was carried out by treating a 5 gram sample of the air-dried stock with 100 cc. of 17.5 per cent sodium hydroxide solution at 20 deg. C. for a period of 30 minutes. After the residue had been filtered in a Buchner funnel, the fibres serving as their own filter mat, it was washed with 1000 cc. of cold water, then with 100 cc. of 20 per cent acetic acid and a liter of hot water. After this, the sample was dried at 105 deg. C. in a weighing bottle, cooled in a desiccator and weighed.

3. COPPER NUMBER.

Technical Association Papers, Series XIII; 273 (May, 1930).

4. VOLUMETRIC β- AND γ-CELLULOSE.

Method 38 of the Forest Products Laboratory[7].

5. PENTOSANS.

Method 45 of the Forest Products Laboratory[8].

6. GLUCURONIC ACID.

This was determined by a modification of Ling's method[9], in which 10 gram samples were distilled with 12 per cent hydrochloric acid for one hour; the carbon dioxide evolved was absorbed in N/10 barium hydroxide and estimated by a back titration with N/10 hydrochloric acid.

7. FORMIC AND ACETIC ACIDS.

Formic and acetic acids going into solution as the re-

[7] Bray, M. W. Methods Used at the Forest Products Laboratory, August, 1928, page 18.

[8] Bray, M. W. Methods Used at the Forest Products Laboratory, August, 1928, page 28.

[9] Nanji, D. R., Paton, F. J. and Ling, A. J. Soc. Chem. Ind. 44; 2531 (1925).

sult of chemical degradation were determined by the method of Evans and Hass[10].

A. The significance of the analytical data.

Unfortunately, the analytical methods commonly employed in following changes in cellulose are empirical. They represent not definite quantities of any one chemical individual, but rather directional tendencies. In the case of the gravimetric α-cellulose determination, we measure partly a rate of solution and partly the presence of such groups as increase the solubility of a compound in alkali through salt formation, et cetera. The rate of solution, in turn, depends in part upon the micellar complexity and chain length, for the less complex the micelle and the shorter the chain, the greater is the solubility in the alkaline solution and the lower the percent of α-cellulose. High α-cellulose content does not necessarily mean high viscosity, for two stocks may have the same α-cellulose content but considerably different viscosities, or micelle sizes. The reverse appears to be true, however, for it has been our experience that a pulp of high viscosity always has a high α-cellulose content. This may be put differently by saying that high micellar complexity always indicates a large per cent of resistant, stable cellulose. The micellar complexity, in original, diminishes at a faster rate than the change in α-cellulose content. Pulps of low micellar complexity and low viscosity never have as high content of α-cellulose as do the pulps of high viscosity. Degradation of a type, hence, is followed analytically first by the drop in viscosity, and then by the drop in α-cellulose content. This is clearly indicated by the data in a paper by Olsen and Aaronson[11], who followed the degradation of cellulose by acids both by viscosity measurements and α-cellulose determinations. In this connection, it should be noted that a relation exists between the viscosity of a stock and its strength as measured both by double folds and by tear; other things being equal, high viscosity, high tear, and high double folds go together.

The copper number value alone is without any special significance. Pulps which have been degraded by hydrolysis or oxidation have very high copper numbers due to two dissimilar reactive groups. Oxidizing agents in degrading cellulose form as by-products modified cellulose of high copper number and of high adsorptive power for basic dyes such as methylene blue. Hydrolytic degradation yields cellulose modifications of high copper number but low adsorptive power for methylene blue. It will be remembered that this is a characteristic difference for the empirical, modified celluloses known as oxy- and hydrocelluloses. In general, an increase in copper number is associated with a decrease in α-cellulose content, as the result of a degradation of cellulose. Fig. 3 graphically illustrates the relationship of a large number of samples picked at random throughout the various degradation series Fig. 3.

Pentosan determinations by phloroglucinol are likewise empirical in that they give a relative measure of the amount of material in a stock which may be converted to furfuraldehyde and modified furfuraldehydes by the action of hydrochloric acid. Such may be pentose units, uronic acid units, and, in some cases, certain hexose sugars. The determination is of value in indicating whether or not a change in the concentration of such bodies is occurring during degradation. If oxidation reactions result in the formation of a carboxyl group from a primary alcohol group, and if this carboxyl is decarboxylated in the manner outlined by Heuser[12] and others, then the estimation of pentosan should be indicative of the rate of such change. The determination of glucuronic acid by measuring the carbon dioxide evolved when the glucuronic acid is decarboxylated should likewise show whether or not the oxidation results in the formation of the uronic acid.

[10] Evans, W. L. and Hass, H. B. J. A. C. S. 48; 2708 (1926).
[11] Olsen, Fred and Aaronson, H. A. Ind. Eng. Chem. 21; 1178-1181 (1929).

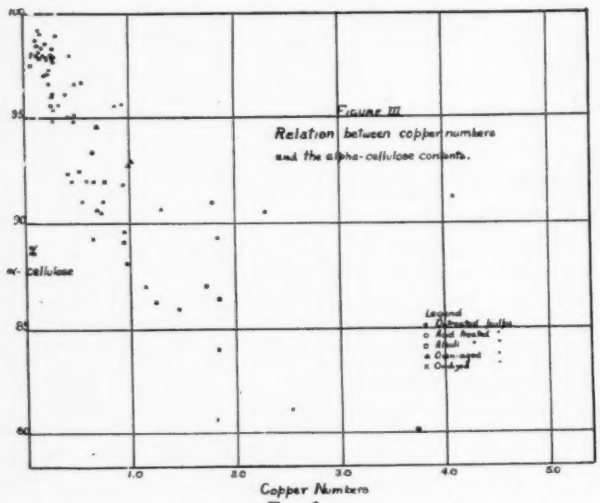


FIG. 3
Relation between copper numbers and the alpha-cellulose contents.

Experimental Results

A. THE COMPOSITION OF THE STANDARD STOCKS.

The stocks before use were disintegrated in a Gosta Hall disintegrator, allowed to air dry, and samples taken for analysis. The constants for the stocks are listed in Table 1. In a number of experiments, other stocks have been used; their chemical constants will be listed in connection with such tests.

TABLE I
CONSTANTS OF THE FIVE STANDARD STOCKS

Stock	Viscosity	α-cellulose	β-cellulose	γ-cellulose	Pentosan	Copper number
No. 1 Muslin	203.0	97.1	2.2	0.0	.73	.204
Blue Overalls	42.8	97.7	3.4	0.0	.68	.273
Thirds and Blues	25.9	96.1	4.4	0.0	.86	.401
Alpha	34.4	91.9	1.5	4.4	4.85	.452
Super Alpha	50.7	91.0	2.7	4.4	5.10	.547

In attempting to identify as much of the pentosan material as possible, xylan was isolated from various pulps. The method of Solokowski[13], which takes advantage of the formation of the copper complex with Fehling's solution and the recovery of xylan from the complex, was employed. From the no. 1 muslin, no xylan at all could be obtained; Super Alpha, on the other hand, yielded 2.4 grams of xylan, and the residue from which the xylan was extracted upon analysis indicated the presence of 2.49 per cent additional pentosan material. In addition, mucic acid corresponding to approximately .2 per cent galactans was isolated from the Super Alpha pulp.

Thus, it is seen that the rag stocks have higher percentages of resistant cellulose than do the purified wood pulps. The less resistant cellulose may be entirely precipitated from the alkaline solution used in the α-cellulose determination by acidification of the solution with acetic acid. The material recovered is β-cellulose. The purified sulphite pulps, in contrast, contain a smaller percentage of this somewhat stable β-cellulose and a greater quantity of the least stable γ-cellulose (cellulose soluble in alkaline and weak acid solutions). In the purified wood pulps a con-

[10] Evans, W. L. and Hass, H. B. J. A. C. S. 48; 2708 1926.
[11] Olsen, Fred and Aaronson, H. A. Ind. Eng. Chem. 21; 1178-1181 (1929).

siderable portion of the non-cellulose fraction is composed of pentosans, and half of this has been isolated as the pentosan xylan. Pentosans are almost entirely missing in the rag pulps; xylan cannot be isolated.

B. THE DEGRADATION OF THE FIVE STANDARD STOCKS BY HEAT.

1. Oven ageing in air at 100 deg. C.

Large samples of the five stocks were disintegrated in a Gosta Hall disintegrator, placed in 2 liter pyrex Erlenmeyer flasks, and heated in a large electric oven to 100 degrees ± 1 degree for the varying times. At the end of the ageing, the samples were allowed to come to an air-dry condition and determinations carried out for moisture, viscosity, α-cellulose and copper number. For ageing in nitrogen and oxygen, the pulps were heated in large pyrex Erlenmeyer flasks fitted with ground glass stoppers and glass inlet and outlet tubes, in the oven described above. The gas being studied was slowly admitted to the flasks during the ageing, the residual air having been first eliminated by means of a vigorous current of the gas.

The data illustrating the changes in these various constants has been arranged in Table II.

TABLE II

Stock	Time of Heating in Hours: 0	48	72	88	96	114	144	288	454	600	852
Changes in Cuprammonium Viscosity											
No. 1 Muslin	203.0	61.9	57.7	48.3	43.2	42.7	34.0	23.0	15.7	12.2	10.3
Blue Overalls	42.8	30.5	24.7	25.9	24.9	24.4	22.4	18.0	14.8	14.0	11.9
Thirds & Blues	25.9	19.6	17.7	17.7	18.1	17.4	16.1	13.5	12.6	10.0	9.7
Alpha	34.4	27.9	26.0	25.9	25.3	24.4	21.2	17.3	15.3	14.3	11.6
Super Alpha	50.7	36.0	32.0	30.7	...	30.0	28.1	22.8	17.6	16.0	13.6
Changes in Copper Number											
No. 1 Muslin	.204		.393						.933		1.18
Blue Overalls	.273		.564						.878		1.11
Thirds and Blues	.401		.682						.876		1.01
Alpha	.452		.682						1.287		1.15
Super Alpha	.547		.739						1.020		1.25
Changes in α-Cellulose Content											
No. 1 Muslin	97.04		96.4					95.7			93.0
Blue Overalls	97.70		96.7					95.6			93.0
Thirds & Blues	96.10		94.6					93.5			92.8
Alpha	91.90		90.6					90.7			87.0
Super Alpha	91.00		90.5					90.4			86.3

As a result of oven ageing, it will be seen that the viscosities of the various stocks fall off in somewhat the same manner. The shape of the curves indicates that the micelle complexity of all the stocks probably differs considerably from that of No. 1 muslin stock. In the course of preparation or in the process of formation in the wood a less complex micelle has apparently resulted. Consequently, the No. 1 muslin stock can be heated for 72 hours before its viscosity approaches the viscosity of the other four stocks. Any considerable decrease in α-cellulose content does not appear until marked viscosity changes have occurred; even at the end of 72 hours, this value has not fallen off more than 1½ per cent in any case. It is interesting to note here that rag stocks may be oven aged for 852 hours at 100 degrees and still have higher content of α-cellulose than the original Alpha pulps. As would be expected, copper numbers have increased, and at the end of 852 hours are approximately the same for all five stocks. The copper number for No. 1 muslin at the end of 72 hours treatment is lower than that of either original Alpha pulps.

2. Oven ageing in air at 150 deg. C.

The same five stocks were aged under the same experimental conditions at 150 deg. C. At this temperature the reaction is much more drastic than at 100 deg. C. After 98½ hours, all the pulps had yellowed, possessed a strong, caramel flavor, and had changed from flexible to very brittle fibres easily powdered by the hand. The viscosities fell off so rapidly that at the end of 24 hours, they were about the same as those which were heated at 100 degrees for three times that length of time, and after 48 hours at 150 degrees, they were equivalent to the value for over 800 hours at 100 deg. C. The α-cellulose content at the end of 98½ hours, likewise, was a great deal lower than that of the stocks heated at 100 degrees for 852 hours. Similarly, the copper numbers of the stocks heated to 150 degrees were the same at the end of 98½ hours as those heated to 100 degrees for 852 hours. The data are outlined and described in Table III.

TABLE III
CHEMICAL CONSTANTS OF STOCK AGED AT 150° C.

Stock	Time in Hours: 0	24	48	98	Copper number After 98 hours	α-Cellulose After 98 hours
No. 1 Muslin	203	50.0	12.9	5.8	1.19	79.1
Blue Overalls	42.8	28.1	17.1	13.0	1.14	81.5
Thirds & Blues	25.9	20.3	12.0	5.8	1.20	78.7
Alpha	34.4	30.3	18.9	14.2	1.20	74.8
Super Alpha	50.7	28.2	15.8	6.8	1.23	73.9

3. Oven ageing in oxygen and nitrogen at 100 deg. C.

In order to determine whether the changes taking place are influenced by oxygen, comparative oven-ageing tests have been carried out in nitrogen and oxygen as well as in air. The analytical data are listed in Table IV. From the data, it will be seen that oxygen has some effect, although rapid degradation as measured by viscosity changes occurs even in the absence of oxygen. Apparently there is sufficient oxygen in the air to permit the maximum oxidation effect for the condition of the end products is the same regardless of whether the heating was carried out in air or in oxygen.

The rates of degradation as measured by viscosity changes upon treating the five stocks in oxygen have likewise been determined. These values have been listed in Table V and diagrammatically represented in Fig 4.

The general shape of the degradation curves of the various types of pulps is clearly seen from an inspection of Fig. 4. Stocks of high viscosity lose a certain amount of this at a rapid rate during the early stages of the degradation. Stocks of lower original viscosity change at a much slower rate in very much the same manner as do the high viscosity stocks during the latter stages of their degrada-

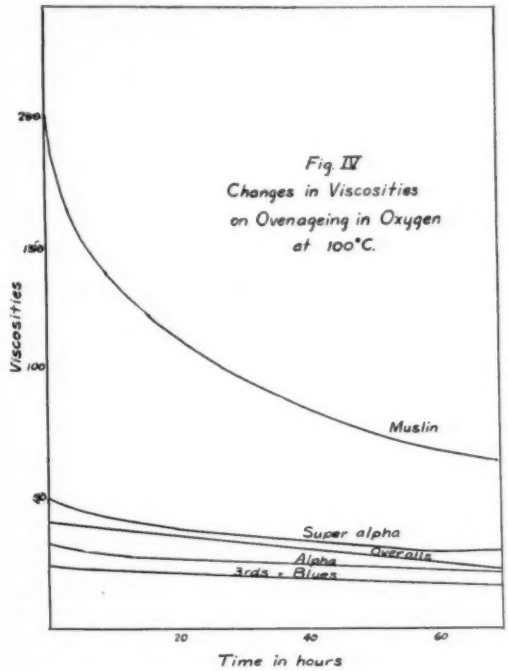


FIG. 4
Changes in viscosities on oven ageing in oxygen at 100 deg. C.

TABLE IV

Stocks	Untreated	Nitrogen	Air	Oxygen
Changes in α-Cellulose Content of Pulps Aged for 72 hours at 100° C.				
No. 1 Muslin	97.1	97.0	96.7	97.0
Blue Overall	97.7	96.9	96.7	96.6
Thirds & Blues	96.1	96.1	94.6	94.5
Alpha	91.9	91.9	90.6	91.5
Super Alpha	91.0	91.2	90.5	90.1
Changes in Copper Numbers of Pulps Aged for 72 hours at 100° C.				
No. 1 Muslin	.204	.341	.393	.403
Blue Overalls	.273	.426	.564	.529
Thirds & Blues	.401	.434	.682	.561
Alpha	.452	.645	.682	.748
Super Alpha	.547	...	.739	.713
Changes in Cuprammonium Viscosities of Pulps Aged for 72 hours at 100° C.				
No. 1 Muslin	203.0	98.0	57.7	58.4
Blue Overalls	42.8	27.7	24.7	22.8
Thirds & Blues	25.9	24.5	17.7	17.5
Alpha	34.4	29.6	26.0	24.3
Super Alpha	50.7	39.4	32.0	31.4

TABLE V
CHANGES IN VISCOSITIES WITH TIME OF HEATING IN OXYGEN

Stock	Time of Heating in Hours 0	12	24	36	48	60	72
No. 1 Muslin	203.0	129.0	121.0	133.0	77.9	58.7	58.4
Blue Overalls	42.8	42.8	36.0	33.0	28.6	26.8	22.8
Thirds & Blues	25.9	23.0	22.0	20.7	18.9	17.7	17.5
Alpha	34.4	29.0	26.0	26.8	21.9	24.2	24.3
Super Alpha	50.7	43.0	39.9	36.3	29.1	30.9	31.4

tion. Only stocks of high viscosities suffer this high initial loss. An explanation of this has been given by Staudinger[14].

4. The nature of the oven ageing reaction products.

The nature of the oven ageing reaction might be clearly understood if the chemical individuals produced as a result of degradation were identified and changes in their concentration followed. Any oxidation of primary alcoholic radicals of the anhydro-sugar rings will yield first aldehydes and then acids. The acids of the type of glucuronic acid will thus be formed from glucose, which upon decarboxylation will give anhydro-pentose rings. Xylose is formed from glucose and glucuronic acid and carbon dioxide evolved as the pentose formation proceeds. During the oven ageing studies, a measure has been made of the amount of carbon dioxide evolved throughout the reaction and changes in pentosan content determined, especially in the case of No. 1 muslin and the Alpha pulps. If carbon dioxide is evolved as the result of decarboxylation of glucuronic acid, it should be reflected by an increase in pentosan content as the result of the conversion of glucuronic acid to pentose. The values obtained have been listed in Tables VI and VII.

TABLE VI
CARBON DIOXIDE LIBERATED DURING OVEN-AGEING EXPRESSED AS PER CENT BY WEIGHT OF MATERIAL
(To convert to anhydro-glucuronic acid, multiply by 4)

Stocks	Time of Heating in Hours 12	24	36	72	240
No. 1 Muslin	No turbidity	.022	.026	.028	.111
Super Alpha	No turbidity	No turbidity	.020	.030	.100

TABLE VII
PENTOSAN DETERMINATIONS ON AIR AGED STOCKS EXPRESSED AS PER CENT PENTOSAN

Stocks	Time of Heating in Hours 0	12	24	72	288	850	1880
No. 1 Muslin	.73	.72	.71	.79	.70	.70	.72
Super Alpha	4.85	...	4.90	4.90	5.05	5.03	4.90

The data which have been obtained are not particularly conclusive. If the decarboxylation is occurring, it is taking place at a very slow rate for the presence of not more than 0.44 per cent glucuronic acid has been shown by the carbon dioxide elimination as the result of heating No. 1 muslin for 240 hours; the similar value for Super Alpha stock is 0.4 per cent. These amounts, however, have not appeared in the pentosan determinations as an increase in pentosan. Either the carbon dioxide did not come from decarboxylation of glucuronic acid or else the pentosans are being slowly decomposed. There is just the barest indication of this given in the analyses of Super Alpha pulp.

[14] Staudinger, H., and Schweitzer, O. Ber. 63: 3122 (1930).

The great difference in pentosan content of rag and Alpha pulp is again illustrated. A more complete series of pentosan determinations on oxygen aged stock has been obtained in which the five stocks have been heated for 144 hours and pentosan determinations made at the end of 36, 72 and 144 hours.

TABLE VIII
PENTOSAN DETERMINATIONS ON OXYGEN AGED STOCKS EXPRESSED AS PER CENT PENTOSAN

Stocks	Time of Heating in Hours 0	36	72	144
No. 1 Muslin	.73	.94	.97	.73
Blue Overalls	.68	.82	.80	.84
Thirds & Blues	.86	.97	.90	.82
Alpha	4.85	5.12	5.25	5.25
Super Alpha	5.10	5.55	5.43	5.11

It is evident to all those who have had experience with the pentosan determination that the above analytical differences do not suggest any outstanding change in pentosan content during the oven ageing of stock. That leads to the conclusion that if these bodies are being formed during the oven-ageing, the process is very slow. This conclusion is supported by the fact that the amount of xylan which may be isolated by one Solokowski extraction from either untreated or 72-hour aged Super Alpha pulp is approximately 2.4 per cent in each case.

C. The degradation of the five stocks by acids.

The second of the degrading influences to be investigated was that of the action of acids on the five pulps. This has been followed by subjecting the five standard pulps used in the last study to three different sulfuric acid concentrations for varying times at a constant temperature, following the changes in the characteristics of the pulps by means of the analytical constants. The concentrations of the sulfuric acid employed were 1 per cent, 10 per cent and 15 per cent. The degradations were carried out by suspending 5 grams of disintegrated air-dry pulp in 100 cc. of the acid in a 125 cc. Erlenmeyer flask. The flasks were tightly stoppered with best-grade red rubber stoppers, fixed in the rotating wheel of a constant temperature water bath, held at 50 deg. C. ± 1 degree and turned for varying periods of time. At the conclusion, the pulps were washed acid-free with cold water, then with hot water, and finally air dried, again disintegrated and bottled in tightly stoppered bottles.

The moistures were run on separate samples and copper number, α-cellulose content and viscosities determined on the air-dry material. The temperature of 50 degrees was used as a result of two trial runs made with 1 per cent sulphuric acid at 70 and 100 degrees. At these temperatures, the pulps were attacked so rapidly that viscosity changes could not be followed satisfactorily, and the copper number increase was likewise extremely rapid.

1. The action of 1 per cent sulphuric acid at 50 degrees.

The analytical data, indicating the changes taking place in the five standard stocks after treatment with 1 per cent sulphuric acid at 50 degrees have been gathered together and appear in Table IX. Changes in viscosity are diagrammatically represented in Fig. 5.

Although the viscosity of Muslin drops off rapidly during the first three hours of hydrolysis, at the end of that time it still possesses a viscosity superior to that of the original Super Alpha pulp. At the end of ten hours of hydrolysis the rate of viscosity change for all stocks becomes very small, although the value is still well up in the measurable range. This indicates that the action of 1 per cent acid at 50 degrees is not extremely drastic, for in the preliminary studies with 1 per cent acid at 100 degrees, heating for 4 hours was sufficient to cause the viscosity of the solution to approach the viscosity of the solvent. Increasing temperature obviously has a marked effect on

TABLE IX
CHEMICAL CONSTANTS OF STOCKS AFTER TREATMENT WITH 1 PER CENT SULPHURIC ACID AT 50°

Stocks	Time of Treatment in Hours: 0	½	1	3	5	10
	Viscosity in Centipoises					
No. 1 Muslin	203.0	118.0	69.0	58.2	40.6	28.7
Blue Overalls	42.8	32.9	29.5	27.2	23.7	16.6
Thirds and Blues	25.9	23.7	18.8	17.1	16.2	13.7
Alpha	34.4	28.7	25.6	24.0	19.9	20.7
Super Alpha	50.7	36.5	36.1	25.8	22.7	21.0
	Copper Number					
No. 1 Muslin	.204			.328	.328	.400
Blue Overalls	.273			.45	.45	.52
Thirds and Blues	.401			.48	.48	.56
Alpha	.452			.56	.60	.60
Super Alpha	.547			.64	.76	.78
	Per cent—α-Cellulose					
No. 1 Muslin	97.04		97.50		95.60	
Blue Overalls	97.73		98.0		95.8	
Thirds and Blues	96.1		95.5		95.3	
Alpha	91.86		92.0		88.5	
Super Alpha	91.0		91.0		89.1	

the action of acid on cellulose. In general agreement with the results obtained in oven-aging, the blue overall stock behaves, from a viscosity standpoint, in about the same manner as do the two Alpha pulps, while the thirds and blues show somewhat lower values.

The α-cellulose content of stocks, in contrast to the viscosity change, is not altered even after treating for 1 hour with the acid. The formation of the so-called hydrolyzed degradation products of cellulose apparently is not responsible for the fall in viscosity for hydrocellulose is quite soluble in alkali; this loss in viscosity must, therefore, be due to physical alteration in the micelle rather than to the formation of chemical degradation products. Even after 5 hours hydrolysis, the α-cellulose content of the stocks has not changed greatly.

Finally, it should be noted in all cases the rag stock values for α-cellulose are higher and for copper numbers are lower than with the Alpha pulps.

2. Degradation with 10 per cent sulphuric acid at 50°.

The second series was carried out in essentially the same manner as the first series using a 10 per cent solution of sulphuric acid. Preliminary runs indicated that degradation takes place at a much greater rate with acids of this strength; consequently, the intermediate series of viscosity measurements were eliminated. The analytical data are found in Table X.

TABLE X
CHEMICAL CONSTANTS OF PULP TREATED WITH 10 PER CENT SULPHURIC ACID AT 50° C.

Stocks	Time of Treatment in Hours: 0	½	1	3	5	20
	Viscosity in Centipoises					
No. 1 Muslin	203.0	34.5			7.2	
Blue Overalls	42.8	16.7			6.9	
Thirds and Blues	25.9	12.6			6.3	
Alpha	34.4	16.0			7.1	
Super Alpha	50.7	17.0			6.0	
	Copper Number					
No. 1 Muslin	.204	.55	.63	1.25	1.80	2.88
Blue Overalls	.273	.59	.70	1.55	2.30	3.24
Thirds and Blues	.401	.62	.81	1.40	1.84	2.69
Alpha	.452	.73	.81	1.14	1.47	2.36
Super Alpha	.547	.88	.96	1.47	1.47	3.28
	Per cent—α-Cellulose					
No. 1 Muslin	97.04		97.5		91.8	
Blue Overalls	97.73		98.0		90.5	
Thirds and Blues	96.1		96.0		88.5	
Alpha	91.86		90.5		85.9	
Super Alpha	91.60		90.0		83.4	

It will be seen from a consideration of the data that copper numbers increase at a much more rapid rate with 10 per cent acid than with 1 per cent acid, that the viscosity falls off at a very rapid rate, the greater share of the drop occurring during the first half-hour of treatment, while the α-cellulose values fall off between five and eight per cent after five hours treatment in place of from 1½ to 3 per cent with 1 per cent acid. It should be noted that in spite of the considerable influence of the 10 per cent acid on the viscosity, no. 1 muslin stock which has been treated with acid of this strength at 50 deg. C. for ½ hour still has a viscosity equal to an α-cellulose content considerably greater, and a copper number only very slightly higher, than the corresponding values for the untreated Alpha pulps. All three rag stocks start with approximately a six per cent higher α-cellulose content than do the Alpha pulps and retain this differential throughout the entire treatment.

3. The Action of 15 per cent acid at 50 deg. C.

Changes in viscosities under these conditions occur too rapidly to follow. To the copper number value and the gravimetric determination of α-cellulose has been added the volumetric determination of β- and γ-cellulose already referred to under the analytical methods employed. The data are listed in Table XI. Changes in α-cellulose content (the significant changes in this degradation) are graphically illustrated in Fig. 6.

TABLE XI
CHEMICAL CONSTANTS OF STOCKS TREATED WITH 15 PER CENT SULPHURIC ACID AT 50° C.

Stocks	Time of Treatment in Hours: 0	5	10	15
	Copper Number			
No. 1 Muslin	0.204	1.46	2.83	3.48
Blue Overalls	0.273	2.40	2.98	3.62
Thirds and Blues	0.401	2.19	2.90	3.35
Alpha	0.452	1.88	2.04	2.74
Super Alpha	0.547	2.13	2.49	2.88
	Per cent—α-Cellulose			
No. 1 Muslin	97.0	91.5	84.2	83.0
Blue Overalls	97.7	91.5	83.2	81.0
Thirds and Blues	96.1	90.4	84.1	80.3
Alpha	91.9	84.9	80.0	76.7
Super Alpha	91.0	86.8	78.3	74.5
	Per cent—β-Cellulose			
No. 1 Muslin	2.2	4.05	4.50	7.87
Blue Overalls	3.40	5.16	6.36	10.18
Thirds and Blues	4.40	4.87	8.88	9.35
Alpha	1.50	4.45	6.26	5.76
Super Alpha	2.65	3.02	6.68	8.68
	Per cent—γ-Cellulose			
No. 1 Muslin	0.00	0.00	0.00	0.00
Blue Overalls	0.00	0.00	0.00	0.00
Thirds and Blues	0.00	0.00	0.00	0.00
Alpha	4.40	1.86	2.67	2.25
Super Alpha	4.40	3.58	2.25	3.15
	Sum of α-, β- & γ-Cellulose			
No. 1 Muslin	99.24	95.55	88.70	90.87
Blue Overalls	101.13	96.66	89.56	91.18
Thirds and Blues	100.50	95.27	92.98	89.65
Alpha	96.76	91.21	88.93	84.10
Super Alpha	98.05	93.40	87.23	86.32

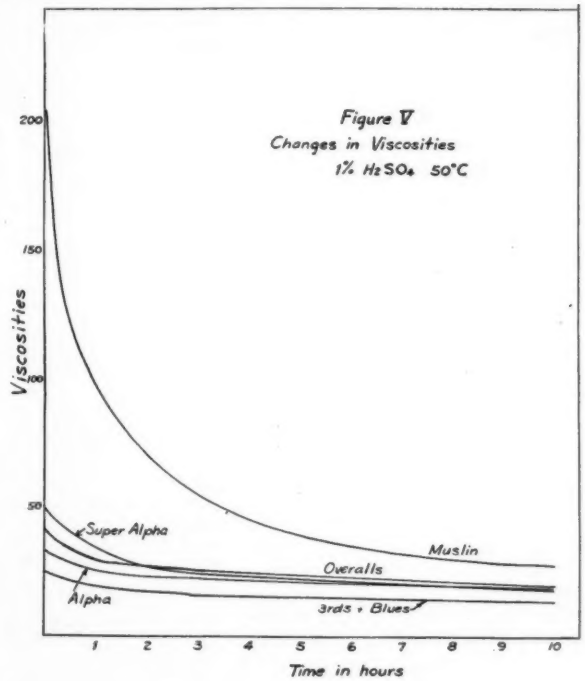


FIG. 5
Changes in viscosities.

The fact of some significance to be noted now in connection with these determinations is that rag stocks contain no γ-cellulose. Wood pulps, on the other hand, contain some considerable amounts of this type of cellulose. There is no evidence to support the belief that γ-cellulose is formed from either α-cellulose or β-cellulose as a result of acid hydrolysis with either rag or Alpha pulps. The absence of γ-cellulose in purified cotton linters as determined gravimetrically, has already been noted by Mahood and Cable.[6]

The second fact of interest to note is that the sum of the gravimetric α-cellulose and volumetric β- and γ-cellulose equals 100 per cent with the rag pulps and is less than 100 per cent with the Alpha pulps. This same difference between the rag and Alpha pulps is to be noted throughout the acid hydrolysis with 15 per cent acid and suggests a difference in the nature of a cellulose in rag stocks and in Alpha pulps.

Changes in pentosan content as the result of acid hydrolysis have likewise been investigated with somewhat the same results as in oven aging. The pentosan content of no. 1 muslin and Super Alpha stocks are the same after treatment with 15 per cent sulphuric acid for 15 hours at 50 degrees as in the original pulps. Pentosans do not form in appreciable amounts during such acid degradation.

D. THE DEGRADATION OF THE FIVE STOCKS BY ALKALINE ACTION

The changes to be investigated cover the action of alkaline solutions in the presence of air, oxygen and nitrogen. The stocks used were the same ones to be described in the last two sections. The effect of alkaline solutions in the presence of air was gone into rather exhaustively, solutions of 1 per cent, 10 per cent, 20 per cent and 30 per cent being employed for times ranging from ± hour to 5 hours. As in the previous section, the degradation of the stock has been followed through a study of the changes occurring in the chemical constants of the pulp. The constants determined include α-cellulose, copper number and cuprammonium viscosity of the residues. The amount of material dissolved by the action of various alkaline solutions was likewise determined, since this is a measure of the relative stability of the stocks toward the peptizing action of the solution as well as their resistance to the formation of soluble compounds by the solution.

The nature of the changes which take place as alkaline solutions of varying concentrations act on cellulose and on pulp has not been established by work reported in the literature. Such substances as "oxycellulose," the hemicellulose, lower carbohydrates and lignin modifications will be soluble to a greater or less degree. Pure cotton, on the other hand, appears to be slowly dissolved by dilute sodium hydroxide solution even at room temperature[15] and it is claimed that this process is more rapidly carried on in the presence of oxygen.[16] This solvent action has not been characterized by the formation of any new or particular type or reaction product; in fact, the information available as to the course of the reaction is extremely sketchy.

Undoubtedly, the alkaline solution has a peptizing action on the cellulose. If this is the case, the extent of solution or peptization may be used as an index of micellar degradation, for the smaller micelles will undoubtedly be peptized more readily than would those of a large size. It should also be possible to follow the course of the micellar degradation in the residue through a study of the cuprammonium viscosity of the residue.

On the other hand, it may be that the impurities present in the fibre are being continuously dissolved, leaving the residue richer in cellulose than was the original material. This would be indicated by a lowering in copper number, an increase in α-cellulose content and possibly by an increase in cuprammonium viscosity. Any loss in α-cellulose itself can also be calculated from the above data.

What actually occurs will depend in a large measure upon the way in which the reaction is carried out. Oxidation will be favored by conditions involving either agitation or a large air-alkali interface with continuous removal of the water vapor or by an atmosphere of oxygen.

Parallel studies with oxygen and nitrogen with 1 per cent and 20 per cent alkali on certain of the stocks and a bleached balsam sulphite pulp have been carried out to indicate whether or not the solution of the pulp by alkali action is indeed an oxidation and whether there is any difference in the rate with which the stocks respond to the oxidizing influence.

1. The action of alkaline solutions in the presence of air.

a. Experimental methods used.

Samples of each of the five standard pulps were treated with 1 per cent, 10 per cent, 20 per cent and 30 per cent sodium hydroxide solutions for ½ hour, 2½ hours and 5 hours. An 8 gram sample of the air-dried shredded pulp was placed in a 500 cc. round bottom flask, and to it was added 150 cc. of the alkaline solution which had previously been heated to boiling. The mouth of the flask was stoppered with a reflux condenser and placed in a constant level boiling water bath for the period of time indicated. At the conclusion of that period, the flask was removed from the bath and the contents filtered in a Buchner funnel, the fibres serving as their own filter mat. The

[6] Mahood, S. A. and Cable, D. E. Ind. Eng. Chem. 14; 727 (1922).

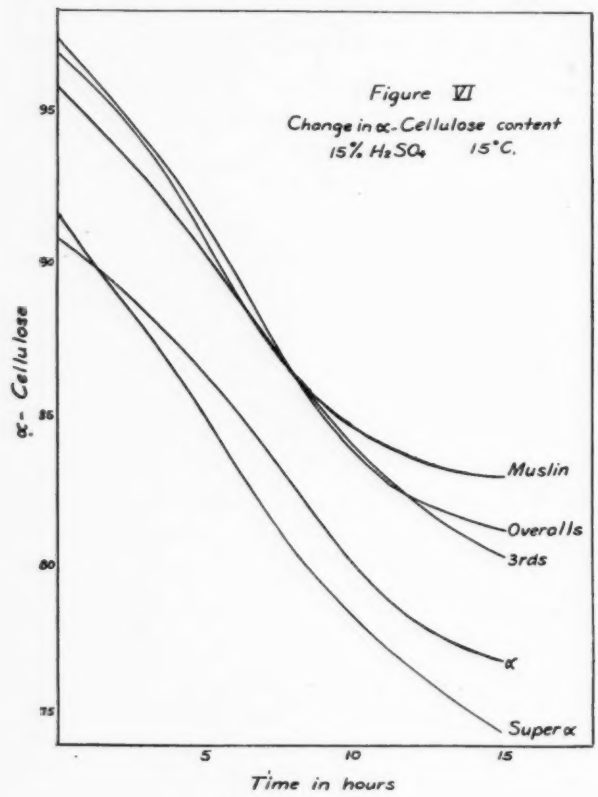


FIG. 6
Changes in alpha-cellulose content.

[15] Schwalbe, C. G. and Robinoff, M. Z. Angew. Chem. 24; 256-258 (1911).
[16] Heuser, E. Textbook of Cellulose Chemistry, page 27, McGraw-Hill Book Company, (1924).

filtrate was used to rinse the flask and was then refiltered through the fiber mat. In addition, the flask was rinsed with 100 cc. of 4 per cent sodium hydroxide solution, which was then used to wash the pulp residues. The insoluble material on the filter was first washed with 1 liter of cold water, following which 100 cc. of 20 per cent acetic acid was allowed to soak through the fibre mat; the acetic acid was then washed out with 1 liter of hot water, after which the residue was removed from the funnel. The residue was air-dried and then placed in a large stoppered sample bottle. The chemical tests were run on portions of this air-dried residue, the moisture content of which was known. The alkaline solutions used were made up approximately and were then adjusted to the proper concentration, which concentration was measured with a Baumé hydrometer.

b. Per cent of the various pulps dissolved by the treatment with alkaline solutions.

The data showing the extent to which the various alkaline solutions had dissolved these pulp stocks are presented in Table XII and in graphic form in Figs. 7 and 8.

It will be seen that an increase in concentration of the alkaline solution results in an increase in solubility up to the action of 20 per cent sodium hydroxide, while the 30 per cent caustic dissolves very much less. This checks with the observation of Ross [17] on cotton and on sulphite pulp. In every case, the Alpha stocks are markedly more soluble than the rag stocks, the solubility ratio in the case of the Super Alpha and the No. 1 muslin being 1.7, 2.8, 2.2, and 2.21 respectively.

The relative behavior of the five stocks is clearly shown by the curves in Figs. 6 and 7. In every case, the three rag stocks are superior in behavior to the two wood pulps and the order for the rag stocks is muslin—blue overalls—thirds and blues. Whether the difference in behavior is due to the fact that the alkaline solutions are in part dissolving pentosan material from the wood pulps and in part peptizing cellulose, and in the rag pulps only peptizing cellulose, it is obvious that the stability of the two types of stocks is markedly different. Data will be presented later to show that this cannot be ascribed to pentosan removal alone but to an inherent difference in the stability of the cellulose itself.

[17] Research Notes of the Canadian Forest Products Laboratory 1; 71 (1927).

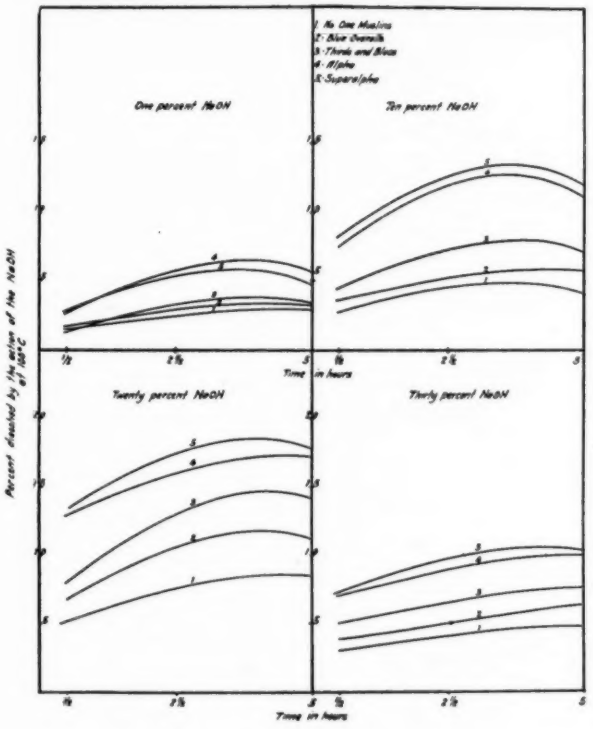


FIG. 7
Relation between the per cent of pulp dissolved and the reaction time.

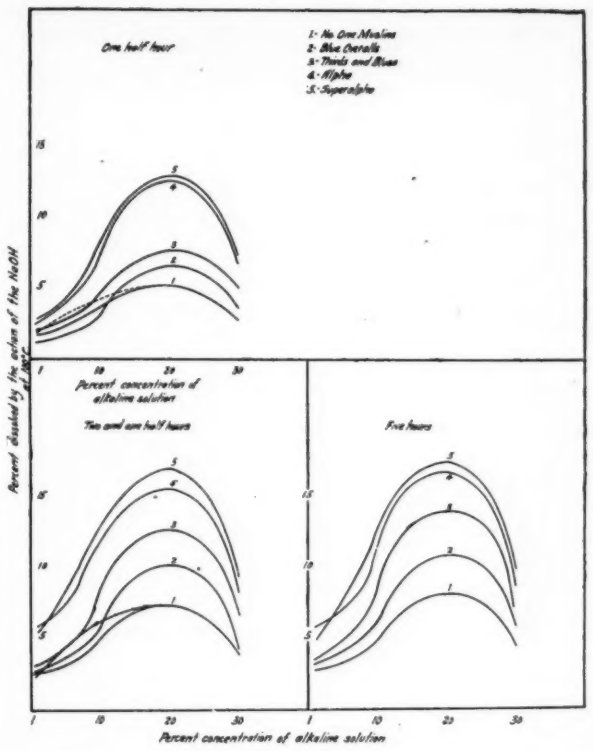

One half hour
1- No. One Muslins
2- Blue Overalls
3- Thirds and Blues
4- Alpha
5- Superalpha
Percent concentration of alkaline solution
Two and one half hours
Five hours
Percent dissolved by the action of the NaOH at 100°C
Percent concentration of alkaline solution

FIG. 8
Relation between the per cent of pulp dissolved and the alkali concentration.

c. The influence of alkaline solutions on the copper numbers of the standard stocks.

When the solvent action is preceded by oxidation, this may be reflected by an increase in copper number. Again, the peptization of the stock with the intermediate formation of the smaller micelles would mean for a given weight of stock in the same volume of solution an increase in available points of attack, such as the reducing groups

TABLE XII
PER CENT OF PULP DISSOLVED BY ALKALINE ACTION AT THE TEMPERATURE OF THE BOILING WATER BATH

Stocks	Time of Treatment in Hours ½	2½	5
1 Per Cent Alkali			
No. 1 Muslin	1.8	2.4	2.9
Blue Overalls	1.3	2.8	3.3
Thirds and Blues	2.0	3.2	3.5
Alpha	2.6	5.6	5.6
Super Alpha	2.8	5.2	4.8
10 Per Cent Alkali			
No. 1 Muslin	3.5	4.4	4.3
Blue Overalls	2.7	5.3	5.8
Thirds and Blues	4.3	7.3	7.3
Alpha	7.5	11.9	11.5
Super Alpha	8.0	12.6	12.0
20 Per Cent Alkali			
No. 1 Muslin	5.1	7.6	8.3
Blue Overalls	6.9	10.5	11.3
Thirds and Blues	8.0	13.0	14.4
Alpha	13.0	15.8	17.2
Super Alpha	13.4	17.3	17.9
30 Per Cent Alkali			
No. 1 Muslin	3.2	3.7	4.7
Blue Overalls	3.7	4.9	6.3
Thirds and Blues	5.0	6.3	7.6
Alpha	7.0	8.9	9.9
Super Alpha	7.1	9.4	10.2

TABLE XIII
THE COPPER NUMBERS OF THE RESIDUES AFTER TREATMENT WITH ALKALINE SOLUTIONS AT THE TEMPERATURE OF THE BOILING WATER BATH

Treated

Stock	Time of Treatment in Hours ½	2½	5
1 Per Cent Alkali			
No. 1 Muslin	.211	.244	.221
Blue Overalls	.208	.246	.267
Thirds and Blues	.425	.310	.288
Alpha	1.182	1.163	.736
Super Alpha	1.748	.961	.758
10 Per Cent Alkali			
No. 1 Muslin	.156	.134	.179
Blue Overalls	.344	.223	.312
Thirds and Blues	.223	.199	.208
Alpha	.724	.222	.296
Super Alpha	.804	.200	.335
20 Per Cent Alkali			
No. 1 Muslin	.160	.140	.140
Blue Overalls	.220	.180	.200
Thirds and Blues	.250	.200	.210
Alpha	.280	.270	.300
Super Alpha	.270	.210	.180
30 Per Cent Alkali			
No. 1 Muslin	.170	.120	.130
Blue Overalls	.230	.180	.190
Thirds and Blues	.230	.240	.230
Alpha	.480	.280	.270
Super Alpha	.460	.400	.410

Untreated

No. 1 Muslin	.204
Blue Overalls	.273
Thirds and Blues	.401
Alpha	.452
Super Alpha	.547

which occur on the free end of the micelle, and for such stocks a greater increase in copper number would be expected.

The data have been listed in Table XIII, while Figs. 9 and 10 illustrate graphically what has taken place. The general shape of the curves indicates the formation of compounds of high reducing power in the Alpha and Super Alpha pulps in these runs, in which the stock has been treated with dilute alkaline solution. As the concentration of the alkali increases, however, such reducing compounds apparently oxidize further to alkali-soluble compounds or are themselves slowly soluble in the alkaline solution. The fact that the Alpha pulps show an increase in copper number

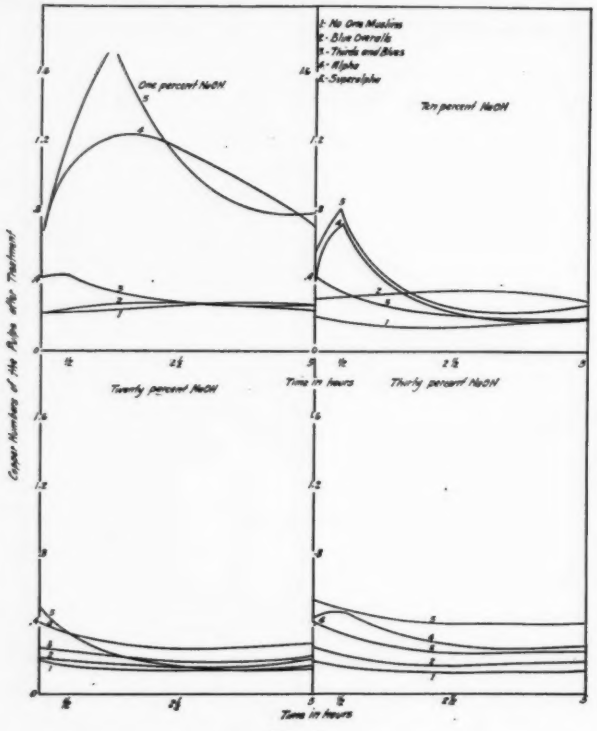


FIG. 9
Relation between the copper numbers and the time of treatment.

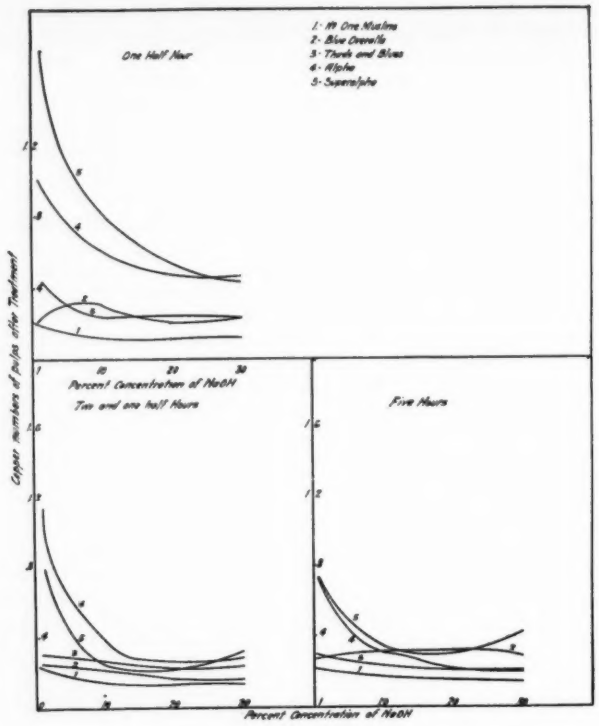


FIG. 10
Relation between the copper number and the alkali concentration.

with the dilute Alkaline solution suggests that there are impurities present in these pulps which are more easily oxidized than is the cellulose itself. These impurities go into solution in the more highly concentrated alkaline solutions to leave a product which is richer in cellulose itself. This checks with the data to be presented in the next section, where the α-cellulose content of the residual material is given.

The fact that the rag stocks yield much lower copper numbers under exactly the same operating conditions indicates a comparatively small concentration of such impurities, or a correspondingly greater stability of the rag

TABLE XIV
THE α-CELLULOSE CONCENTRATION OF THE RESIDUES FROM THE TREATMENT WITH ALKALINE SOLUTIONS AT THE TEMPERATURE OF THE BOILING WATER BATH

Treated

Stock	Time of Treatment in Hours ½	2½	5
1 Per Cent Alkali			
No. 1 Muslin	97.9	96.6	97.9
Blue Overalls	98.0	97.3	95.6
Thirds and Blues	96.1	95.9	95.8
Alpha	91.1	91.3	93.2
Super Alpha	87.0	89.6	92.0
10 Per Cent Alkali			
No. 1 Muslin	99.3	99.2	99.1
Blue Overalls	97.2	98.4	97.1
Thirds and Blues	97.9	97.2	97.6
Alpha	94.7	95.4	97.0
Super Alpha	93.7	95.2	95.7
20 Per Cent Alkali			
No. 1 Muslin	98.4	98.6	98.7
Blue Overalls	97.6	98.3	98.5
Thirds and Blues	95.7	98.2	98.1
Alpha	98.0	97.4	97.9
Super Alpha	97.5	96.7	99.2
30 Per Cent Alkali			
No. 1 Muslin	97.2	98.5	98.1
Blue Overalls	97.9	98.1	96.7
Thirds and Blues	94.9	96.4	96.0
Alpha	95.0	95.6	94.2
Super Alpha	94.8	95.0	94.3

Untreated

No. 1 Muslin	97.1
Blue Overalls	97.7
Thirds and Blues	96.1
Alpha	91.9
Super Alpha	91.0

TABLE XV
THE CHANGES IN CUPRAMMONIUM VISCOSITIES OF THE STANDARD PULPS UPON HEATING WITH ALKALINE SOLUTIONS

Stocks	Time of Treatment in Hours: ½	2½	5
Treated			
1 Per Cent Alkali			
No. 1 Muslin	74.5	48.3	67.2
Blue Overalls	27.2	13.3	31.8
Thirds and Blues	20.4	20.6	19.6
Alpha	9.9	9.6	13.7
Super Alpha	9.2	13.0	22.0
10 Per Cent Alkali			
No. 1 Muslin	162.9	152.4	104.6
Blue Overalls	33.8	31.4	21.3
Thirds and Blues	27.4	22.3	24.5
Alpha	11.5	26.4	33.3
Super Alpha	16.5	31.7	27.7
20 Per Cent Alkali			
No. 1 Muslin	88.5	104.0	99.2
Blue Overalls	26.6	28.6	31.3
Thirds and Blues	22.4	20.5	17.3
Alpha	19.9	18.4	17.0
Super Alpha	35.4	18.3	26.7
30 Per Cent Alkali			
No. 1 Muslin	83.0	103.5	83.2
Blue Overalls	28.4	26.3	24.1
Thirds and Blues	16.7	18.9	18.2
Alpha	16.5	15.4	12.8
Super Alpha	27.2	17.1	18.5
Untreated			
No. 1 Muslin	203.0		
Blue Overalls	42.8		
Thirds and Blues	25.9		
Alpha	34.4		
Super Alpha	50.7		

cellulose toward the oxidizing action of the alkaline solutions.

d. The influence of alkaline digestion on the α-cellulose content of the standard stocks.

The determination of α-cellulose content is, in reality, a second alkaline treatment, where 17.5 per cent sodium hydroxide solution reacts with the pulp for a period of 30 minutes at a temperature of 20 deg. C.

The data on the α-cellulose values of the residual pulps are presented in Table XIV, while Figs. 11 and 12 illustrate graphically what has taken place during this treatment.

The possible formation of substances of relatively high

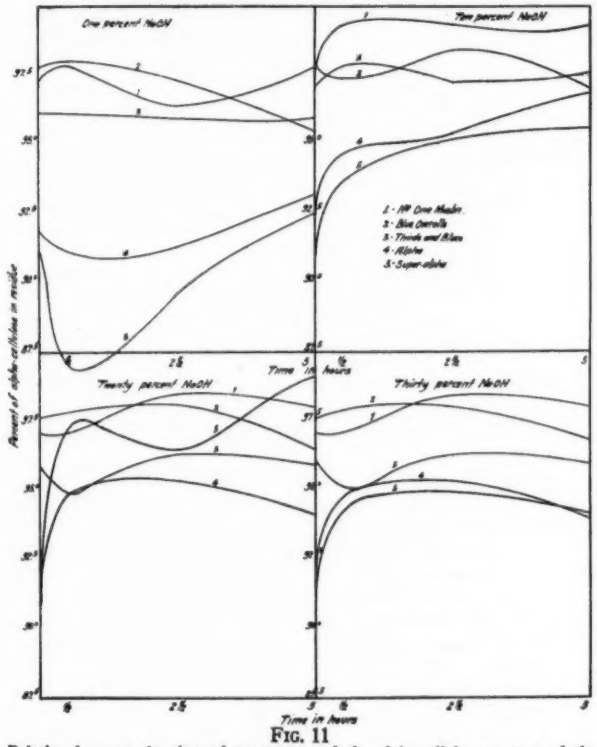


FIG. 11
Relation between the time of treatment and the alpha-cellulose content of the residue.

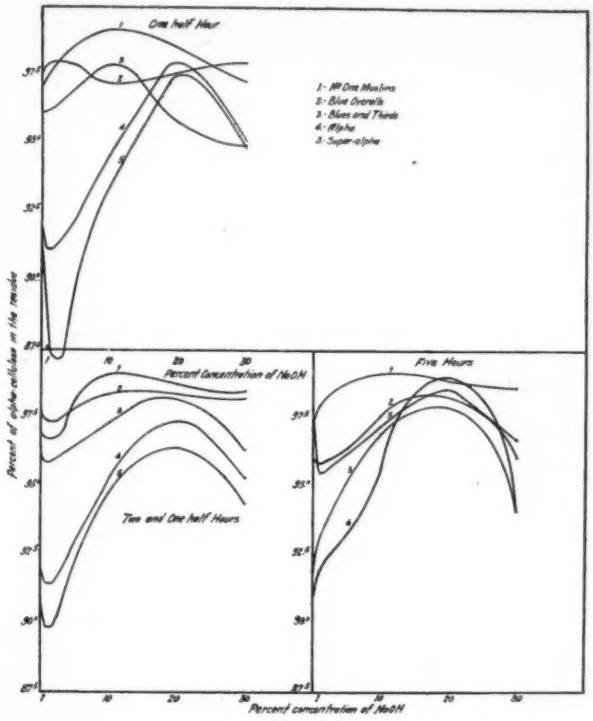

One half Hour
Two and One half Hours
Five Hours
Percent concentration of NaOH
Percent of alpha-cellulose in the residue
1 - Mill One Muslins
2 - Blue Overalls
3 - Blues and Thirds
4 - Alpha
5 - Super-alpha

FIG. 12
Relation between the concentration of the NaOH and the alpha-cellulose content of the residue.

copper number and great solubility in 17.5 per cent alkaline solution by the action of 1 per cent sodium hydroxide on the Alpha pulps is shown by a glance at the curves.

e. Changes in the viscosities of the cuprammonium solutions of the standard stocks as a result of the alkaline action.

The data illustrating the change in the viscosities of the cuprammonium solutions of the standard stocks as a result of alkaline action are shown in Table XV.

2. The action of alkaline solutions in the presence of oxygen or nitrogen.

In addition to treating the pulps with alkaline solutions in the presence of air, selected samples have been exposed to the action of these same solutions in the presence of oxygen and nitrogen respectively. The purpose of this was to determine to what extent on the one hand the alkaline degradation might be looked upon as an oxidation in which atmospheric oxygen was required, and on the other how much of the change was due to peptization by the action of the alkaline solution alone.

Four stocks were investigated and the results compared

TABLE XVI
THE SOLUBILITIES OF SELECTED PULPS IN 1 AND 20 PER CENT SODIUM HYDROXIDE SOLUTIONS IN NITROGEN, AIR AND OXYGEN

Stocks	Oxygen 0% Nitrogen 100%		Oxygen 20% Nitrogen 80% (Air)		Oxygen 100% Nitrogen 0%		Time in Hours
	1% NaOH	20% NaOH	1% NaOH	20% NaOH	1% NaOH	20% NaOH	
No. 1 Muslin	1.1	3.4	1.8	5.1	2.8	5.4	½
	1.6	6.8	2.4	7.6	3.4	7.2	2½
	2.0	8.0	2.9	8.3	3.8	7.5	5
Overalls	1.1	3.4	1.3	6.9	3.0	7.5	½
	1.9	8.5	2.8	10.5	4.3	10.6	2½
	2.2	10.1	3.3	11.3	4.8	11.2	5
Alpha	2.0	12.9	2.8	13.4	4.7	11.2	½
	3.3	14.5	5.2	17.3	6.1	17.1	2½
	4.0	17.0	4.8	17.9	6.2	17.9	5
Sulphite	8.7	30.0	..	..	10.2	32.7	½
	16.4	39.3	..	...	19.4	38.1	2½
	19.1	39.4	.	...	21.0	38.7	5

with the above data on air-alkaline action. These stocks included the muslin, blue overalls and alpha stocks and for comparative purposes, a bleached sulphite stock of the ordinary type. Alkaline solutions of 1 per cent and 20 per cent were studied the pulps being subjected to the action of these solutions at a temperature of 100 degrees and the nitrogen or oxygen gas passed through the reacting mixture during the entire course of the operation. The products were analyzed for loss in weight to determine the per cent dissolved and changes in α-cellulose content, copper number and viscosities. The analytical data are outlined in Table XVI.

a. Rates of solution of the stocks in alkaline solution in the presence of nitrogen, air and oxygen.

It will be apparent that the dissolving action of 1 per cent NaOH solution on pulps is in part a function of the oxygen present, the oxygen in the air being an active agent, and in part may be ascribed to peptization. With 20 per cent sodium hydroxide solutions, however, oxygen has less influence and the solution is due largely to peptization of the pulps or their reaction products.

The greater resistance of the rag stocks to solution by the alkaline solutions is again noted. In every case, the wood pulps prove to be more susceptible to alkaline action, due in part to the less resistant impurities in the wood pulp.

b. Changes in α-cellulose content.

TABLE XVII
CHANGES IN α-CELLULOSE CONTENTS OF THE VARIOUS STOCKS

Stock	1 Per Cent NaOH Nitrogen	1 Per Cent NaOH Air	1 Per Cent NaOH Oxygen	20 Per Cent NaOH Nitrogen	20 Per Cent NaOH Air	20 Per Cent NaOH Oxygen	Hours Time in
No. 1 Muslin	97.1	97.1	97.1	97.1	97.1	97.1	0
	97.6	97.9	98.5	98.0	98.4	...	½
	98.6	96.6	97.2	99.4	98.6	97.9	2½
	98.2	97.9	97.1	98.9	98.7	98.2	5
Overalls	97.7	97.7	97.7	97.7	97.7	97.7	0
	97.8	98.0	96.8	98.7	97.6	97.6	½
	98.2	97.3	96.5	97.8	98.3	96.9	2½
	97.4	95.6	95.8	97.5	98.5	98.1	5
Alpha	91.0	91.0	91.0	91.0	91.0	91.0	0
	91.8	87.0	89.1	99.0	97.5	97.0	½
	92.0	89.6	89.4	97.8	96.7	97.3	2½
	92.5	92.0	91.0	97.5	...	97.0	5
Sulphite	80.2	80.2	80.2	80.2	80.2	80.2	0
	86.4	...	84.0	96.3	...	94.8	½
	89.1	...	88.2	96.5	...	94.0	2½
	90.1	...	88.5	96.4	...	94.5	5

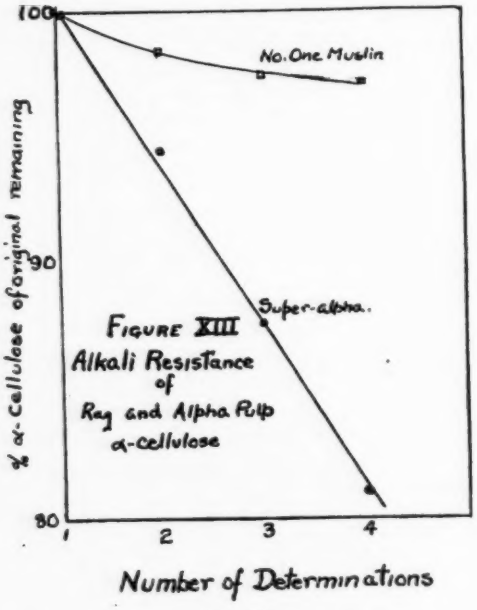


FIG. 13
Alkali resistance of rag and alpha pulp alpha-cellulose.

3. Relative resistance of the α-cellulose in rag and alpha pulps toward alkaline action

Additional experiments have been carried out to establish without question whether there was any difference in the rate at which α-cellulose was being removed from the various stocks by alkaline action. Much work had already been done at various times to determine the nature of the α-cellulose residues left from the α-cellulose determinations. For example, viscosity tests on these residues established the fact that cold 17.5 per cent sodium hydroxide solution was lowering the viscosities of the rag and wood stocks at different rates. Since the determination is carried out for 30 minutes at 20 degrees, the degradation is relatively mild, but the results show that a much higher percentage of the original viscosity is retained by the rag pulps than by the Alpha pulps.

TABLE XVIII
THE VISCOSITIES OF α-CELLULOSE RESIDUES OBTAINED FROM THE DETERMINATIONS OF α-CELLULOSE

Stock	Original Viscosity Centipoises	Viscosity of α-Cellulose Centipoises	No. of Check Samples	Per cent of Retention
No. 1 Muslin	203.0	139.	3	68.5
Blue Overalls	42.8	33.9	3	78.2
Thirds and Blues	25.9	18.9	3	73.0
Alpha	34.4	10.8	6	31.1
Super Alpha	50.7	23.6	4	46.5

Work presented before the 1932 Fall Meeting of the American Chemical Society by R. A. Gortner and J. J. McNair on the collodial non-identity of α-cellulose from different wood sources shows that the order of resistance of the α-cellulose of sulphite pulps to the peptizing action of cold 17.5 per cent NaOH is: Spruce, jackpine, flax, tamarack, white pine, birch, Norway pine, balsam, aspen. This order of resistance was determined by subjecting the dried pulps to the approved treatment for the α-cellulose determination. The method used is exactly the same as that recommended by the Technical Association of the Pulp and Paper Industry for the determination of α-cellulose.[18] Residues were combined and retreated, the process being repeated until six successive treatments had been made. They find that the percentages of α-cellulose when plotted against the number of determinations fall in a straight line. We have carried out their technic on No. 1 muslin and Super Alpha pulp with approximately the same results. These results as indicated in Table XIX and Fig. 13 show in a striking manner the difference in resistance to peptization of the α-cellulose present in the respective pulps. The results have been plotted and appear in Fig. 12.

TABLE XIX
THE RESISTANCE TO PEPTIZATION BY COLD 17.5 PER CENT NaOH OF THE α-CELLULOSE IN NO. 1 MUSLIN AND IN SUPER ALPHA PULP

Stock	Number of α-Cellulose Treatments 1	2	3	4	5
	Per Cent Insoluble				
No. 1 Muslin	97.8	98.4	98.9	99.8	99.8
Super Alpha	90.0	94.5	92.7	92.3	93.7
	Per cent α-Cellulose of original α-Cellulose remaining after treatment				
No. 1 Muslin	100	98.4	97.4	97.1	96.8
Super Alpha	100	94.5	87.7	80.9	75.8

4. Summary of the action of alkaline solutions.

The large amount of experimental evidence which has been accumulated throughout the above studies on the action of alkaline solutions on the pulp stocks in atmospheres of air, oxygen and nitrogen shows the superiority of the rag stocks towards degradation by alkalis. As a result of alkaline action under the various conditions, a considerably greater percentage of the wood pulps dissolves than is the case with the rag stocks. The residue remaining in the case of the rag stocks contains a greater percentage of the original α-cellulose than does that from the wood stocks. That the basic difference in solubility

[18] Technical Association Papers, Series XV; 142 (June, 1932).

of rag and wood cellulose is tied up in large part with a dissimilarity in either the physical or chemical nature of the Alpha pulp is shown rather clearly by the very great difference in the rate of solution on continued α-cellulose determinations.

It is not possible to draw conclusions with any degree of certainty from the copper numbers, since products of high copper numbers are either not formed or are dissolved during alkaline action and leave a residue with a very low copper number. In spite of this, the 1 per cent NaOH solution appears to yield a substance of high copper number as a primary product of alkaline action with the Alpha pulps.

Viscosity determinations of the alkali treated products all show the superior collodial properties of No. 1 muslin as compared with the other stocks. Of purely theoretical interest is the observation that alkaline solutions attack pulps in part by peptization and in part by oxidation.

E. THE DEGRADATION OF THE FIVE STOCKS BY THE ACTION OF LIGHT.

1. Studies with the "violet carbon arc" fadeometer.

a. Experimental methods.

In connection with the general program of investigation of the relative stabilities of rag and wood pulps, a preliminary investigation has been conducted which tends to show the effect of light from at least two sources. In one, the Fadeometer, as manufactured by the Atlas Electric Devices Company, has been employed, using 220 volt. 60 cycle current. Hand sheets of approximately the same basis, weight, and thickness were prepared from stocks which had been rapidly beaten at a 2 per cent consistency in a 10-pound Dilts beater so as to secure a cutting effect. These were made so as to caliper between 0.0055 and 0.0066 inches, cut to fit the sample holders and exposed in the Fadeometer to the action of the "violet carbon arc" for varying lengths of time. In order to accord a general basis for comparison with the earlier work, the same grades of rag and purified wood stocks have been studied; a degraded overbleached No. 1 muslin has also been included.

In the first series of tests, three of the original stocks, namely, overalls, thirds and blues, and Super Alpha, with the new overbleached No. 1 muslin, were studied. Determinations were made of changes in copper number, α-cellulose and pentosan content and 1 per cent sodium hydroxide solubility. Because of the large amount of samples required for these analyses, it was necessary to carry out a complete series on one pulp at a time. In a later investigation in which viscosity changes alone were measured, the development and use of a semi-micro viscosity method permitted simultaneous investigation of the entire series of stocks. This obviated any possible difference in operating conditions which might have influenced the earlier results. The experiments were made with new samples of all five stocks obtained from different mill sources.

b. Experimental results.

The chemical constants of the stocks which had been exposed to the "violet carbon arc" in the Fadeometer are gathered together in Tables XX and XXI. In Table XX are the results of the first investigation and in Table XXI those of the second. The entire data are graphically illustrated in Fig. 14.

c. Discussion of results.

An extremely interesting observation appears as a result of a survey of the viscosity changes: The light of the "violet carbon arc" in the Fadeometer is decreasing the viscosities of the Alpha pulps at a faster rate than is the case with rags of corresponding value. This is the first time in the entire study in which this effect has been noted. Moreover, copper numbers and 1 per cent sodium hydroxide solubilities show a greater rate of increase with Super Alpha pulp than the rag pulps. There is no noticeable change in pentosan content throughout the entire study which suggests that this effect, which is in part, at least, photochemical, does not result in oxidation and decarboxylation through the glucuronic acid stage. It is not possible to state at the present time what waves, either

TABLE XX
CHEMICAL CONSTANTS OF STOCKS AGED IN THE FADEOMETER
(First Series)

Stock	Time of Treatment in Hours 0	30	48	72
Viscosity Changes				
No. 1 Muslin	44.0	39.3	32.6	28.2
Blue Overalls	42.6	36.8	31.6	29.5
Thirds and Blues	26.1	22.3	22.0	21.8
Super Alpha	64.3	36.1	31.8	22.7
Copper Number				
No. 1 Muslin	.32	.41	.43	.53
Blue Overalls	.25	.40	.39	.47
Thirds and Blues	.36	.67	.69	.66
Super Alpha	.54	.92	.98	1.19
1 Per Cent NaOH Solubility				
No. 1 Muslin	1.51	2.48	2.04	1.96
Blue Overalls	1.77	2.90	1.97	2.39
Thirds and Blues	1.68	2.53	2.47	2.33
Super Alpha	2.50	3.30	2.92	3.80
Pentosan Content				
No. 1 Muslin	.97	1.05	1.05	.95
Blue Overalls	.72	.67	.78	.66
Thirds and Blues	.67	.73	.75	.67
Super Alpha	5.01	5.08	5.08	4.88
α-Cellulose				
No. 1 Muslin	97.4	...	...	96.9
Blue Overalls	96.9	...	...	96.4
Thirds and Blues	95.8	...	...	93.4
Super Alpha	91.0	...	...	89.2

TABLE XXI
VISCOSITY CHANGES OF STOCKS EXPOSED IN THE FADEOMETER
(Second Series)

Stock	Time of Treatment in Hours 0	12	24	49
No. 1 Muslin	161	118	104	49.1
Blue Overalls	32.8	28.0	27.3	23.7
Thirds and Blues	16.0	15.2	14.6	13.4
Alpha	50.7	31.7	23.4	17.5
Super Alpha	62.8	44.5	33.5	19.7

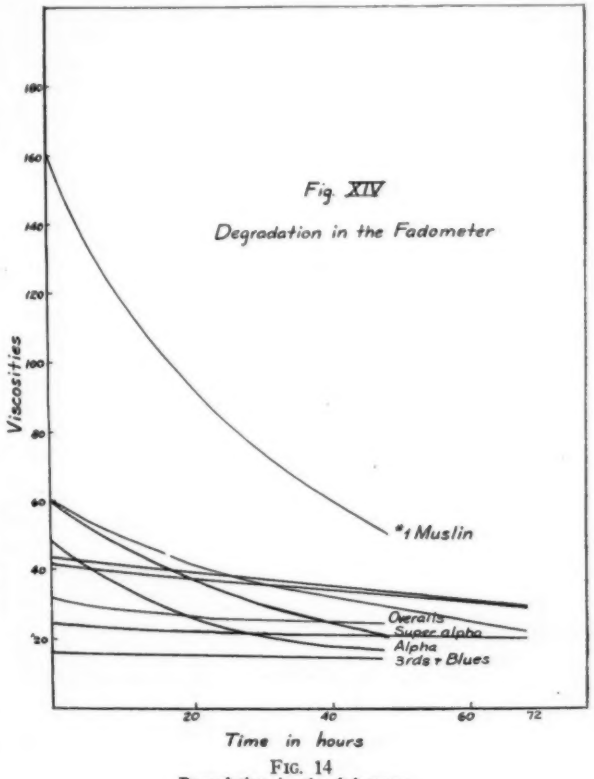


FIG. 14
Degradation in the fadometer.

in the visible or in the ultra violet region, are responsible for this differential in degradation. An investigation is in progress at the Institute of Paper Chemistry at the present time in which, through the aid of a Bausch and Lomb medium quartz spectograph and a Bausch and Lomb quartz ultraviolet monochromator, this information is being collected.

In the Fadeometer, the carbon arcs are surrounded by a glass shield made of a special glass. That the effect is not one of temperature was determined by using the unexposed portions of the test sheets for the blank determinations; the results check the constants on the original stocks very closely. A certain amount of ozone is present as can be ascertained readily from the odor, and it is possible that a portion of the degradation, at least, is due to this. This will be established also by the experiments now in progress at the Institute of Paper Chemistry.

2. Studies with the Cooper-Hewitt quartz mercury vapor lamp (Type Lab. Arc).

a. Experimental method and results.

Sheets of paper of definite area, made in the same manner as that described in the previous section, were exposed at a point exactly six inches in front of the lamp holder for ½ hour, 2 hours and 4 hours. These times were selected in view of the fact that the degradation by the mercury vapor lamp is very much more severe than that caused by the Fadeometer. Our results indicate that 4 hours' exposure in the mercury vapor lamp brings about approximately the same amount of degradation as exposure for 49 hours on the Fadeometer.

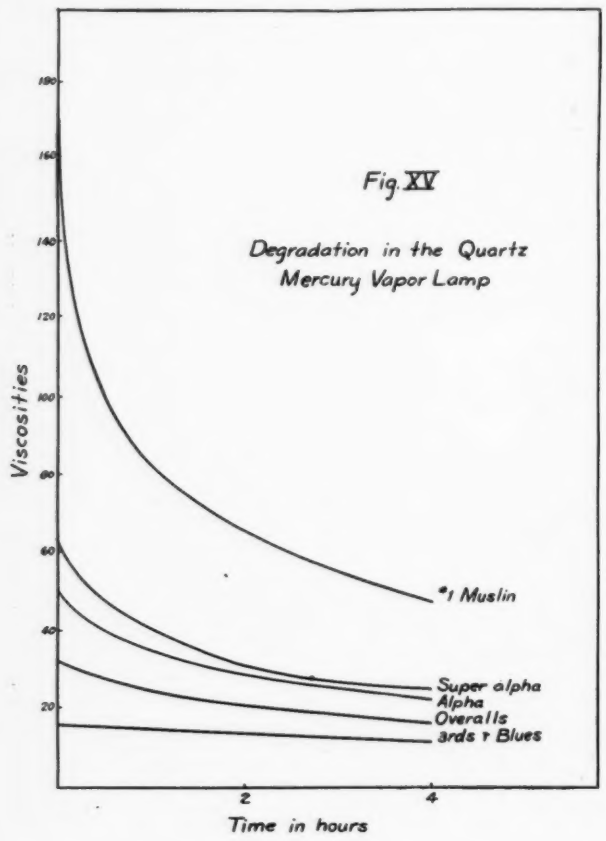


FIG. 15
Degradation in the quartz mercury vapor lamp.

The same micro-method for viscosity determinations was used throughout this study; in this, samples of paper weighing 50 milligrams are dissolved in a definite volume of cuprammonium solution, approximating 5 cc., and the solution and determination carried out in a small tube approximately 5½ inches long and $\frac{5}{16}$ inches inside diameter. Viscosity changes alone were followed because of the extremely small amount of sample. In contrast with the results obtained in the Fadeometer, the viscosity changes followed the same regular curves as have been noted in degradation by heat and acids, the wood pulps degrading at approximately the same rate as the rag pulps of the same original viscosity. Data describing the changes in viscosities are listed in Table XXII and graphically illustrated in Fig. 15.

TABLE XXII

CHANGES IN VISCOSITY

Stock	Time of Treatment in Hours 0	½	2	4
No. 1 Muslin	161	100	64.7	48.1
Blue Overalls	42.9	27.6	21.3	16.1
Thirds and Blues	16.0	15.3	13.5	12.2
Alpha	50.7	40.0	23.9	21.9
Super Alpha	62.8	48.7	31.4	25.5

b. Experimental Discussion.

A comparison of the absorption spectra made with the Bausch and Lomb medium quartz spectograph shows that the two light sources have in them light of different wave lengths and intensities. Wave lengths of light are present in the Fadeometer light which appear to degrade the Alpha pulps selectively; this is not the case with the mercury lamp. A determination of the nature of these wave lengths forms the basis of one phase of our present investigation.

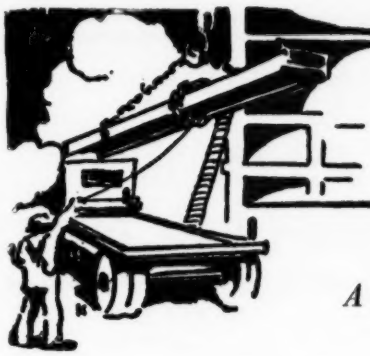
A. If cellulose is looked upon as a polymerized body composed of anhydroglucose units, the rag pulps studied may be said to be richer in cellulose than Alpha pulps. The Alpha pulps contain approximately 5 per cent of pentosan material at least half of which has been isolated as xylan. Rag pulps contain, on the other hand, less than 0.7 per cent of pentosan material.

B. The α-cellulose of no. 1 muslin stock is appreciably more resistant to the repeated peptizing action of cold 17.5 per cent sodium hydroxide solution than is the α-cellulose present in Super Alpha pulp. This indicates for these two pulps a considerable difference in collodial structure, in favor of the rag stock.

C. Because of their inherently higher α-cellulose content, rag stocks withstand the degrading action of heat, alkaline solutions, acid solutions and light from at least two sources, for considerably longer periods of time than can the Alpha pulps. In other words, the rag pulps are more resistant to degradation by the above agencies than are the Alpha pulps.

D. Light from the carbon arc of the Fadeometer causes the Alpha pulps to lose their viscosities at a faster rate than the rag stocks. Viscosity-time curves of the Alpha pulps based upon changes in the Fadeometer cut across similar curves of the rag stocks of lower original viscosities. The colloidal structure of the Alpha pulps, therefore, is more readily altered by the action of light of these characteristics than is that of the rag pulps.

E. The viscosity of rag stock from new unbleached muslin is greater than that of the other stocks. This pulp, consequently, may be degraded for long periods of time by the various reagents, retaining, meanwhile, more desirable strength characteristics than are possessed by the other stocks before degradation.



CONSTRUCTION NEWS

A Summary of Vital Facts Regarding Construction, Finances and Operation of Paper Mills

Construction News

New York, N. Y.—The Cleveland Container Company, 10630 Berea road, Cleveland, Ohio, manufacturer of paper boxes and containers, paper tubes, etc., has arranged for a ten-year lease of space in Starrett-Lehigh Building, 601 West 26th street, New York, totaling about 30,000 square feet of floor area, and will occupy for new eastern branch plant. Present branch container factory at Fifteenth and Bloomfield streets, Hoboken, N. J., will be removed at once to new location, where capacity will be increased. Company is also operating branch plants at Detroit, Mich., and Philadelphia, Pa., and these will be continued in service as heretofore. Willard F. Walker is president.

Grand Rapids, Minn.—The Blandin Paper Company, First National Bank Building, St. Paul, Minn., is completing construction of a three-story addition to power plant at mill at Grand Rapids, previously referred to in these columns, 32 x 54 feet, and will have the unit ready for service at an early date. Large increase in former capacity has been arranged. The new unit will represent an investment of about $125,000, with equipment. James Leck Company, 211 South Eleventh street, Minneapolis, Minn., is general contractor. Richard E. Lutz, Corn Exchange Building, Minneapolis, is consulting engineer.

Long Island City, N. Y.—The Liberty Corrugated Container Company, organized to manufacture corrugated boxes and containers, has concluded arrangements for lease of portion of the Boyce Building, 21 Wilbur avenue, Long Island City, consisting of main floor of 18,000 square feet floor space, and about one-half of basement, totaling 7,000 square feet. Space will be occupied at once for new plant. It is expected to have the unit ready for operation at an early date.

Mosinee, Wis.—The Mosinee Paper Mills Company, Mosinee, and the Tomahawk Kraft Paper Company, Tomahawk, Wis., are arranging plans for a reorganization and consolidation, prepared by a protective committee for the bondholders of the two companies. The new company forming the consolidation of interests will issue bonds totaling about $1,500,000, and 300,000 shares of common stock, a part of the fund to be used for operating capital for the two plants.

Toronto, Ont.—The Robert Gair Company, 420 Lexington avenue, New York, N. Y., manufacturer of corrugated and other paper boxes and containers, has arranged for the purchase of plant and assets of Firstbrook Boxes, Inc., Toronto, manufacturer of kindred paper and paperboard containers, in receivership for some weeks past. Purchasing company will take over and operate as a unit of its organization in Canada.

Fredericksburg, Va.—The Sylvania Industrial Corporation, 122 East 42nd street, New York, manufacturer of transparent cellulose wrapping materials, has awarded contract to the McClintic-Marshall Company, Oliver Building, Pittsburgh, Pa., for structural steel framing for new additions to mill at Fredericksburg, consisting of two one-story structures to form a new operating unit, and superstructure will soon begin. Company has also made award to Taylor-Davis, Inc., 4250 Wissahickon avenue, Philadelphia, Pa., for about 130 tons of reinforcing steel for project. Order for other material and equipment will soon be placed. General contract was let recently to the Hughes-Foulkrod Company, Schaff Building, Philadelphia, as reported in these columns. The Ballinger Company, 105 South Twelfth street, Philadelphia, is architect and engineer.

New York, N. Y.—The Perfect Patent Folding Box Company, 36 West 24th street, manufacturer of folding paper boxes and containers, has leased two floors in the building at 626-30 West 44th street, and portion of second floor in adjoining building to rear at 627-41 West 43rd street, and will occupy for a new plant. It is understood that present works will be removed to new location and capacity increased.

Cincinnati, Ohio—The United States Playing Card Company, Park avenue, manufacturer of card stocks, etc., is reported to be planning an expansion and development program at its paper and card converting plant to cost close to $200,000. Work will be carried out over term of months and will provide for increased output.

Hastings, Minn.—The Smead Manufacturing Company, operating a paper converting plant for the manufacture of heavy filing envelopes and kindred paper products, has approved plans for a new plant unit on Second street. It will be two-story, 23 x 70 feet, and used for increase in present output. General contract has been let to the W. C. Graus Construction Company, Hastings.

Los Angeles, Cal.—The National Card, Mat and Board Company, care of Albee & Watkinson, 525 Fidelity Building, Los Angeles, representatives, recently organized with a capital of $75,000, is said to be arranging early operation of a local converting plant for the production of card and paper products of various kinds. Incorporators of the new company include C. H. and C. W. Crysler, 4318 Carroll avenue, Chicago, Ill., who will head new company.

St. Louis, Mo.—The Sefton National Fibre Can Company, 3275 Big Bend road, manufacturer of fiber containers, cans, boxes, etc., is said to be planning an expansion and modernization program at plant to cost about $30,000. Work will be carried out at early date.

New York, N. Y.—The Ace Paper Company, 139 Spring street, has leased space in the building at 127-33 Bleecker street, and will occupy for increase in storage and distributing facilities. It is understood that company will remove from present location to new building.

IMPORTS OF PAPER AND PAPER STOCK

NEW YORK, BOSTON, PHILADELPHIA AND OTHER PORTS

NEW YORK IMPORTS

WEEK ENDING NOVEMBER 19, 1932

CIGARETTE PAPER

American Tobacco Co., Amer. Shipper, Havre, 100 cs.; Suarez & Crespo, Cypria, Alicante, 4 cs.; Standard Products Corp., Samaria, Southampton, 12 cs.; Liggett & Myers Tobacco Co., Samaria, Southampton, 8 cs.; American Tobacco Co., Pr. Harding Havre, 50 cs.; Champagne Paper Corp., Pr. Harding, Havre, 58 cs.

WALL PAPER

Chase National Bank, Brazil, Maru, Hamburg, 5 cs.; F. J. Emmerich, Britannic, Liverpool, 2 bls.

NEWS PRINT

W. H. Bell Markland Liverpool, N. S., 342 rolls; Jay Madden Corp., Erlangen, Bremen, 288 rolls; International Paper Co., P. T. Dodge, Dalhousie, 3086 rolls; Parsons & Whittemore, Inc., Elsa Menzell, Sundsvall, 15 rolls; ——, Bergensfjord, Oslo, 298 rolls.

PRINTING PAPER

International F'd'g Co. H. Jaspar, Antwerp, 17 cs.; Keuffel & Esser Co., Brazil Maru, Hamburg, 21 rolls; Winsor Newton, Inc., Samaria, Southampton, 3 cs.; H. Reeve Angel & Co. Inc., Samaria, Southampton, 1 cs.; M. Grumbacher, McKeesport, Havre, 16 bls.; P. C. Zuhlke, Westernland, Antwerp, 10 cs.; E. Dietzgen & Co., Veendam Rotterdam, 45 cs.

WRAPPING PAPER

———, Amer. Shipper, Hamburg, 35 rolls; F. C. Strype, Westernland, Antwerp, 3 cs.; Van Oppen & Co., Excalibur, Genoa, 11 cs.; Walker Goulard Plehn Co., Erlangen, Bremen, 556 rolls.

PACKING PAPER

Blauvelt Wiley Paper Manfg. Co., Veendam, Rotterdam, 7 bls.

DRAWING PAPER

Keuffel & Esser Co., Brazil Maru, Hamburg, 43 cs., 7 rolls; Keuffel & Esser Co., Amer. Shipper, Hamburg, 3 cs.; H. Reeve Angel & Co., Inc., Samaria, Southampton, 2 cs.

FILTER PAPER

H. Reeve Angel & Co. Inc., Samaria, Southampton, 4 cs.

COLORED PAPER

Borden Riley Paper Co., Westernland, Antwerp, 2 cs.; S. Gilbert, Erlangen, Bremen, 2 cs.; F. Murray Hill Co., Pr. Harding Hamburg, 5 cs.

BARYTA COATED PAPER

Globe Shipping Co., Erlangen, Bremen, 51 cs.; Globe Shipping Co., Europa, Bremen, 11 cs.

METAL COATED PAPER

Happel & McAvoy, Pr. Harding, Hamburg, 7 cs.; Freddman & Slater, Pr. Harding, Hamburg, 1 cs.

DECALCOMANIA PAPER

B. F. Drankenfeld & Co., Britannic, Liverpool, 2 cs. (duplex); Vernon Potteries Co., Ryoyo Maru, Kobe, 2 cs.; L. A. Consmiller, Europa, Bremen, 9 cs.; Sellers Transportation Co., Europa, Bremen, 9 cs.; Sellers Transportation Co., Pr. Harding, Hamburg, 6 cs.

TISSUE PAPER

B. F. Drakenfeld & Co., Britannic, Liverpool, 2 cs.; W. J. Byrnes, Britannic, Liverpool, 3 cs.

WRITING PAPER

L. Bamberger & Co., Amer. Shipper, Havre, 3 cs.; R. H. Macy & Co., Amer. Shipper, Havre, 5 cs.; Japan Paper Co., Samaria, Southampton, 2 cs.; Beckhard Simfred Co., Pr. Harding, Havre, 2 cs.; D. C. Andrews & Co., Pr. Harding, Havre, 2 cs.

ENVELOPES

Beckhard Simfred Co., Europa, Bremen, 7 cs.

PAPER BOARD

Colmar Paper Corp., Westernland, Antwerp, 10 cs.

CARD BOARD

America Express Co., Amer. Shipper, Hamburg, 250 cs.; Framerican Importing Co., Excambion, Marseilles, 9 cs.; G. Gennert, Pr. Harding, Hamburg, 4 cs.

PASTE BOARD

———, Erlangen, Bremen, 83 cs.

MISCELLANEOUS PAPER

Globe Shipping Co., Samaria, Southampton, 2 cs.; Corn Exchange Bank Trust Co., Ryoyo Maru, Kobe, 13 cs.; J. Romer, Ryoyo Maru, Kobe, 5 cs.; Van Vlaanderen Machine Co., Pr. Roosevelt, Havre, 20 cs.; Happel & McAvoy, Pr. Harding, Hamburg, 2 cs.

RAGS, BAGGINGS, ETC.

I. Hinerfeld, Amer. Farmer, London, 31 bls. rags; D. M. Hicks, Inc., Cameronia, Glasgow, 77 bls. paper stock; ———, Amer. Shipper, Hamburg, 40 bls. rags; E. J. Keller Co. Inc., Amer. Shipper, ——— 53 bls. rags; Guaranty Trust Co., Ida Trieste, 345 bls. rags; J. Cohen Son & Co., Veendam, Rotterdam, 6 bls. rags; J. Garvan Inc., Cristobal, Colon, Havana, 89 bls. rags.

GLUE STOCK, ETC.

———, Vulcania, Trieste, 550 bags hide glue; ———, Westernland, Antwerp, 150 bls. glue stock; ———, Erlangen, Bremen, 200 bags hide glue.

OLD ROPE

Bank of N. Y. Trust Co., Samaria, Southampton, 85 coils; Banco Coml Italiane Trust Co., Erlangen, Bremen, 104 coils; Banco Coml Italiane Trust Co., Cristobal, Colon Pasages, 136 coils; ———, Bristol City, Bristol, 56 coils.

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Orbis Products Trading Co., Bristol City, Bristol, 168 bags; ———, Bristol City, Bristol, 75 bags.

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New York Market Review

Office of the PAPER TRADE JOURNAL,
Wednesday, November 23, 1932.

Conditions in the local paper market are fairly satisfactory. Demand for the various standard grades of paper is moderately active. Sales forces of the leading paper organizations are conducting a strenuous campaign for orders. The price situation is somewhat irregular.

The position of the news print market is practically unchanged. Production in the United States and Canada is being maintained in sufficient volume to take care of current requirements. An encouraging factor in the situation is the statement made at the annual meeting of the Association of National Advertisers last week that 35 per cent of the reporting companies plan to increase their appropriations for 1933 by 35 per cent over 1932.

The paper board market is exhibiting a strong undertone. Demand for the various grades of box board is persistent. Prices are firmer. The fine paper market is practically marking time. Tissues are going forward in good volume. The coarse paper market continues dull. The price situation is unsatisfactory.

Mechanical Pulp

Trading in the ground wood market is moderately active. Demand for both imported and domestic mechanical pulp is mostly routine. Offerings are adequate to meet current needs. Accumulations are not excessive, however, and prices are generally steady and unchanged.

Chemical Pulp

Steadiness prevails in the chemical pulp market. Practically all the grades of domestic and imported chemical are holding up well, with the exception of bleached soda pulp, which is easier, and is now offered at from $2.00 to $2.25 per 100 pounds, delivered paper mills.

Old Rope and Bagging

The old rope market continues listless. Demand for both domestic and imported old manila rope is restricted. Small mixed rope continues dull. Prices are fairly steady. The bagging market is irregular. While scrap bagging is fairly active, gunny bagging is only in moderate request. Roofing bagging is fairly steady.

Rags

Paper mill demand for the various grades of domestic rags is rather quiescent at present. Cotton cuttings are only moving slowly. Roofing grades, however, are holding up as well as may be expected. Prices are nominal. The imported rag market is still influenced by foreign exchange fluctuations.

Waste Paper

The lower grades of paper stock are still in good demand. Offerings of strictly folded news, over-issue news and No. 1 mixed paper are limited, particularly the former. Prices are firmer. Strictly folded news is now quoted at from 45 cents to 50 cents and No. 1 mixed paper is selling at from 17½ cents to 22½ cents, f.o.b. New York.

Twine

Demand for the various grades of twine is well maintained. Supplies are moving into consumption in good volume. Inquiries are fairly numerous and the outlook for the future is promising. Despite keen competition for desirable orders, prices are holding to formerly quoted levels, in most instances.

LIQUIDATOR FOR ABITIBI

(Continued from page 15)

machinery in the plant valued at $73,000, for which it will take 73,000 shares of common stock. The new company also assumes outstanding bank loans. E. Victor Donaldson, president of Firstbrook Boxes, Ltd., is also president of the United States company. Directors of Firstbrook Boxes are: J. W. Gardner, vice-president, G. H. Nuntz, George E. W. de Clercq, New York; A. O. Doherty, George M. Willoughby and George W. Brown. There is a total of 60,000 shares of common stock outstanding as of July 1, 1932, with 7 per cent of the voting preferred to the amount of $496,600.

It is learned that E. A. Rockett, manager of the woodlands Division of the New Brunswick International Paper Company, confirms the report that the company will buy pulpwood from the farmers in the Restigouche district. It is understood that the quantity will be considerable, but the probable price has not yet been announced. The proposition that the wood be purchased has been under consideration of the Dalhousie Board of Trade for some time, that body having approached the company, showing them the advantage of the idea both for the company and the residents.

A petition seeking permission to float 900,000 cords of Quebec wood, destined for Iroquois Falls, Ont., on rivers forming the watercourses of Lake Abitibi has been presented to the Public Service Commission by representatives of the Abitibi Power and Paper Company. In the petition it was pointed out that the Abitibi company intended purchasing this amount of wood for its mills at the Falls, and that it desired to float the wood for the distance between the place where the wood is purchased and its mills in Ontario. The wood would be bought this autumn and winter, but the company is seeking priority rights until next June. No decision was reached.

Clifford Radcliffe, a member of the sales organization of the Westminster Paper Mills, New Westminster, B. C., has been placed in charge of the middle west area and has moved to Winnipeg where he will make his headquarters.

Walter Crawford has been appointed mill manager at the plant of the Dominion Boxboards, Ltd., Toronto, and has entered on his duties. He was formerly with the Sutherland Paper Company, Kalamazoo, Mich.

Despite numerous postponements, the Sidney Roofing and Paper Company, Ltd., still intends to go ahead with the erection of its insulation board plant in Victoria, B. C., according to the announcement by Robert W. Mayhew, president and general manager of the company. The project is estimated to cost $200,000.

LOCKWOOD'S DIRECTORY

OF THE PAPER AND ALLIED TRADES

1933 EDITION

CORRECTED UP-TO-DATE

CONTENTS

Entire contents classified under separate headings for the United States and Canada, alphabetically and geographically arranged by states.

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Classified List of Pulp Mill Products
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Envelope Manufacturers
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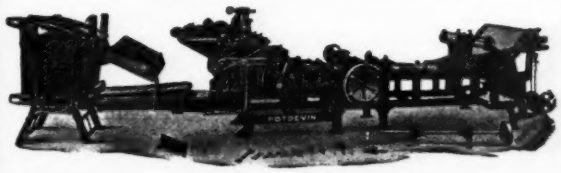

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Miscellaneous Markets

Office of the PAPER TRADE JOURNAL,
Wednesday, November 23, 1932.

BLANC FIXE.—No radical changes were reported in the blanc fixe market. Prices are holding to schedule. The pulp is quoted at from $42.50 to $45.00 per ton, in bulk; while the powder is selling at from 3½ cents to 3¾ cents per pound, in barrels, at works.

BLEACHING POWDER.—The position of the bleaching powder market is practically unchanged. Shipments against contract are going forward in moderate volume. Bleaching powder is quoted at from $1.75 to $2.00 per 100 pounds, in drums, at works.

CASEIN.—The casein market continues firm. Domestic standard ground is quoted at 7 cents and finely ground at 8 cents per pound. Argentine standard ground is still selling at 8 cents and finely ground at 8½ cents per pound, all in bags, car lot quantities.

CAUSTIC SODA.—Some improvement was noticed in the caustic soda market. Contract prices have been advanced 5 cents. Solid caustic soda is quoted at from $2.55 to $2.60; while the flake and ground are selling at from $2.95 to $3.00 per 100 pounds, in large drums, at works.

CHINA CLAY.—The china clay market is fairly active. Prices are generally holding to formerly quoted levels. Imported china clay is selling at from $10 to $15 per ton, ship side; while domestic paper making clay is offered at from $5 to $12 per ton, at mine.

CHLORINE.—Paper mill demand for chlorine is fairly persistent. The contract movement is well up to average. Prices are holding to schedule. Chlorine is quoted at $1.55 per 100 pounds, in tanks, or multi-unit cars, in ton lots, or over, at works.

ROSIN.—The rosin market is steady to firm. Grades of gum rosin used in the paper mills are now quoted at from $3.85 to $3.90 per 280 pounds, in barrels, at works; while wood rosin is selling at $2.80 per 280 pounds, in barrels, at southern shipping points.

SALT CAKE.—Steadiness prevails in the salt cake market. Prices are holding to schedule. Salt cake is quoted at from $15 to $16; chrome salt cake at from $12 to $13 per ton, in bulk, at works; while foreign salt cake is selling at from $14 to $15 per ton, ship side.

SODA ASH.—Demand for soda ash is fairly persistent. Contract prices for 1933 show an advance of $1.00 per ton. Quotations on soda ash, in car lots, at works, per 100 pounds, are now as follows: in bulk, $1.05; in bags, $1.30; and in barrels, $1.43.

STARCH.—Most of the business transacted in the starch market during the past week was along routine lines. Prices are steady. Special paper making starch is still quoted at $2.29 per 100 pounds, in bags; and at $2.56 per 100 pounds, in barrels, at works.

SULPHATE OF ALUMINA.—Conditions in the sulphate of alumina market are fairly satisfactory. Prices remain unchanged. Commercial grades are quoted at from $1.25 to $1.40; while iron free is selling at from $1.90 to $2.05 per 100 pounds, in barrels, at works.

SULPHUR.—The sulphur market continues steady. Sulphur is quoted at $18 per long ton, on orders of 1,000 tons, or over, on yearly contracts; and at $20 per ton on any smaller quantity over that period. On spot and near by car loads, the quotation is $21 per ton.

TALC.—Business in the talc market is moderately active. Prices are holding to schedule. Domestic talc is still quoted at from $16 to $18 per ton, in bulk, at mine; while imported talc is selling at from $18 to $22 per ton, in bags, ship side.

Market Quotations

Paper

(F. o. b. Mill)

Leggers	6.50	@	38.00
Bonds	4.50	@	53.25
Index	6.00	@	12.00
Writings—			
Extra Superfine	6.50	@	15.00
Superfine	6.25	@	14.75
Tub sized	4.50	@	7.00
Engine sized	4.00	@	5.00
Book, Cased—			
S. & S. C.	5.25	@	—
M. F.	3.75	@	5.00
Coated and Enamel	6.25	@	9.75
Litnograph	6.75	@	11.25
Tissues—Per Ream—			
White No. 1	.50	@	.70
Anti-Tarnish M. G. only	.65	@	.70
Colored	.70	@	.90
White No. 2	.55	@	.60
Kraft	.65	@	.70
Manila	.55	@	.60
Manila—			
No. 1 Jute	9.00	@	9.25
No. 2 Jute	7.75	@	8.50
No. 1 Wood	4.00	@	5.25
No. 2 Wood	3.50	@	4.00
Butchers	3.37½	@	—
Fibre Papers—			
No. 1 Fibre	4.25	@	5.50
No. 2 Fibre	4.00	@	4.75
Common Bogus	1.50	@	3.00
Screenings	2.00	@	3.00
Card Middies	4.00	@	5.00
Glassine—			
Bleached, basis 25 lbs., No. 1	.09¼	@	—
No. 2	.11¼	@	—
Bleached, basis 20 lbs.	.11¼	@	—

(Delivered New York)

News, per ton—			
Roll, contract	45.00	@	—
Rolls, spot	45.00	@	—
Sheets	50.00	@	—
Side Runs	30.00	@	35.00
Kraft—			
No. 1 Domestic	4.75	@	6.00
No. 2 Domestic	2.50	@	2.75
Southern	2.25	@	2.50
Imported	2.75	@	3.50
Boards—per ton—			
News	27.50	@	30.00
Straw	29.50	@	31.50
Chip	25.00	@	27.50
Binders' Boards	62.00	@	70.00
Kraft Liner	40.00	@	45.00
Standard 85 Test Jute Liner	27.00	@	29.50
Sgl. Mla. Ll. Chip	37.50	@	40.00

(F. o. b. Mill)

Wood Pulp Boards	70.00	@	80.00

Mechanical Pulp

(On Dock)

No. 1 Imported—			
Moist	17.00	@	20.00
Dry	17.00	@	20.00

(F. o. b. Mill)

No. 1 Domestic	16.00	@	24.00

Chemical Pulp

(On Dock, Atlantic Ports)

Sulphite (Imported)—			
Bleached	1.90	@	2.25
Easy Bleaching	1.60	@	1.75
No. 1 strong unbleached	1.40	@	1.60
Mitscherlich unbleached	1.55	@	1.75
No. 2 strong unbleached	1.25	@	1.35
No. 1 Kraft	1.40	@	1.65
No. 2 Kraft	1.30	@	1.40
Sulphate—			
Bleached	1.85	@	2.15

(F. o. b. Pulp Mill)

Sulphite (Domestic and Canadian)—			
Bleached	1.75	@	3.75
Easy Bleaching	1.75	@	1.90
News	1.50	@	1.65
Mitscherlich unbleached	2.25	@	2.55
Kraft (Domestic)	1.50	@	2.75

(Delivered Paper Mills)

Soda Bleached	2.00	@	2.25

Domestic Rags

New Rags

(Prices to Mill f. o. b. N. Y.)

Shirt Cuttings—			
New White ,No. 1.	4.00	@	4.25
New White, No. 2.	3.00	@	3.25
Silesias No. 1	3.75	@	4.00
New Unbleached	5.50	@	6.00
New Soft Blacks	2.75	@	3.00
Blue Overall	3.00	@	3.50
Fancy	1.50	@	1.75
Washables	1.15	@	1.40
Mixed Khaki Cuttings	2.50	@	3.00
Pink Corset Cuttings	2.75	@	3.25
O. D. Khaki Cuttings	3.00	@	3.25
Men's Corduroy	1.00	@	1.25
New Mixed Blacks	2.25	@	2.50

Old Rags

White, No. 1—			
Repacked	3.00	@	3.50
Miscellaneous	2.00	@	2.25
White, No. 2—			
Repacked	1.75	@	2.00
Miscellaneous	1.50	@	1.75
Thirds and Blues—			
Repacked	1.50	@	1.75
Miscellaneous	1.00	@	1.25
Black Stockings	2.00	@	2.25
Roofing Rags—			
No. 1	.53	@	.58
No. 2	.48	@	.53
No. 3	.43	@	.48
No. 4	.38	@	.43
No. 5A	.33	@	.38

Foreign Rags

New Rags

New Dark Cuttings	1.40	@	1.50
New Mixed Cuttings	1.60	@	1.75
New Light Silesias	3.00	@	3.25
Light Flannelettes	2.50	@	2.75
Unbleached Cuttings	4.75	@	5.25
New White Cuttings	4.00	@	4.25
New Light Oxfords	3.00	@	3.25
New Light Prints	1.85	@	2.25

Old Rags

No. 1 White Linens	5.25	@	5.50
No. 2 White Linens	4.50	@	4.75
No. 3 White Linens	3.25	@	3.75
No. 4 White Linens	1.75	@	2.25
No. 1 White Cotton	3.50	@	3.75
No. 2 White Cotton	2.75	@	3.25
No. 3 White Cotton	2.25	@	2.50
No. 4 White Cotton	1.40	@	1.50
Extra Light Prints	1.80	@	2.00
Ord. Light Prints	1.60	@	1.75
Med. Light Prints	1.40	@	1.55
Dutch Blue Cottons	1.35	@	1.40
French Blue Linens	1.80	@	1.90
German Blue Linens	1.70	@	1.80
German Blue Cottons	1.20	@	1.25
Checks and Blues	1.25	@	1.30
Lindsay Garments	.75	@	.80
Dark Cottons	.70	@	.75
Old Shopperies	.55	@	.60
New Shopperies	.60	@	.65
French Blues	1.25	@	1.30

Old Rope and Bagging

(Prices to Mill f. o. b. N. Y.)

Gunny No. 1—			
Foreign	1.00	@	1.10
Domestic	1.15	@	1.25
Wool Tares, light	.80	@	.85
Wool Tares, heavy	.80	@	.85
Bright Bagging	.75	@	.80
Small Mixed Rope	.80	@	.90
Manila Rope—			
Foreign	1.45	@	1.50
Domestic	1.50	@	1.75
New Burlap Cut	1.65	@	1.75
Hessian Jute Threads—			
Foreign	2.60	@	2.75
Domestic	2.80	@	3.00

Old Waste Papers

(F. o. b. New York)

Shavings—			
White Envelope Cuttings	1.70	@	1.80
Ordinary Hard White No. 1	1.55	@	1.65
Hard White No. 2	1.30	@	1.40
Soft White No. 1	1.40	@	1.50
Flat Stock—			
Stitchless	.55	@	.65
Overissue Mag.	.55	@	.65
Solid Flat Book	.50	@	.55
Crumpled No. 1	.40	@	.45
Solid Book Ledger	1.50	@	1.75
Ledger Stock	.45	@	.55
New B. B. Chips	.20	@	.25
Manilas—			
New Env. Cut	1.25	@	1.35
New Cuttings	1.00	@	1.05
Extra No. 1 old	.80	@	.90
Print	.35	@	.40
Bogus Wrapper	.30	@	.35
Container	.25	@	.30
Old Kraft Machine—			
Compressed bales	.75	@	.85
News—			
No. 1 White News	1.05	@	1.15
Strictly Overissue	.50	@	.55
Strictly Folded	.45	@	.50
No. 1 Mixed Paper	.17½	@	.22½

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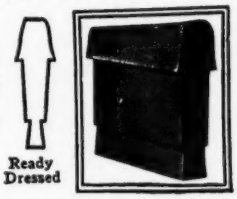

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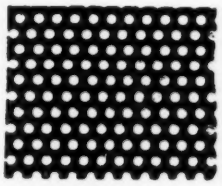

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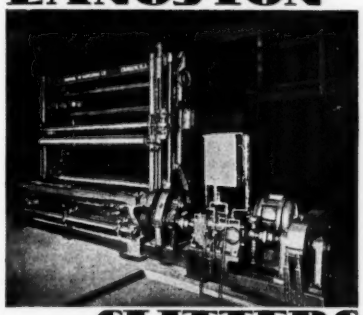

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in Canada

319 Castle Bldg., Montreal, Que.

Twines
(F. o. b. Mill)

Cotton—			
B. C., 18 basis	.30	@	.32
No. 1	.20	@	.22
No. 2	.19	@	.20
No. 3	.17	@	.18
A. Italian, 18 basis	.36	@	.37
Finished Jute—			
Dark, 18 basis	.18	@	.20
Light, 18 basis	.20	@	.22
Jute Wrapping, 3-6 Ply—			
No. 1	.15½	@	.16½
No. 2	.11¾	@	.12¾
Tube Rope—			
4-ply and larger	.10¼	@	.10¾
Fine Tube Rope—			
4-ply	.12¼	@	.12¾
3-ply	.13¼	@	.13¾
2-ply	.14¼	@	.14¾
Paper Makers Twine Balls	.09½	@	.11¼
Box Twine, 2-3 ply	.11¼	@	.12¼
Jute Rope	.09	@	.10
White Hemp	.12¼	@	.12¾
Java Sisal—			
No. 1 Basis	.10	@	—
No. 2 Basis	.09	@	—
New Zealand Sisal	.10	@	—
Sisal Lath Yarn—			
No. 1	.12	@	.14
No. 2	.10	@	.12
Manila Twine	.23	@	.28

CHICAGO

Paper
(F. o. b. Mill)

Rag Bond	.30	@	.53¼
Water Marked Sulphite Bond	.09	@	.12
Sulphite Bond	.04	@	.11
Superfine Writing	.18	@	.24
No. 1 Fine Writing	.14	@	.18
No. 2 Fine Writing	.12	@	.14
No. 3 Fine Writing	.07	@	.18
No. 1 M. F. Book	.06½	@	.07¾
No. 2 M. F. Book	.05¼	@	.06¾
No. 1 S.&S.C. Book	.06¾	@	.07¾
No. 2 S.&S.C. Book	.05¾	@	.06½
Coated Book	.07½	@	.12
Coated Label	.07½	@	.10
No. 1 Manila	.04¼	@	.05¾
No. 1 Fibre	.04¾	@	.05¼
No. 2 Manila	.04¼	@	.04¾
Butcher's Manila	.03¼	@	.03¾
No. 1 Kraft	3.50	@	4.50
Southern Kraft	2.62½	@	—
No. 2 Kraft	2.62½	@	—
Wood Tag Boards	.04¾	@	.06¾
Sulphite Screenings	.03	@	.03½
Manila Tissue	.07	@	.07¼
White Tissue	.07¼	@	.07½

(Delivered Central Territory)

News, per ton—			
Rolls, contract	45.00	@	—
Sheets	50.00	@	—
Boards, per ton—			
Plain Chip	27.50	@	—
Solid News	30.00	@	—
Manila Lined Chip	37.50	@	—
Patent coated	47.50	@	—
Container Lined—			
85 Test	50.00	@	55.00
100 Test	55.00	@	60.00

Old Papers
(F. o. b. Chicago)

Shavings—			
No. 1 White Envelope cuttings	1.50	@	1.55
No. 1 Hard White	1.40	@	1.45
No. 1 Soft White	1.00	@	1.10
Ledger & Writings	.45	@	.55
Solid Books	.25	@	.30
Blanks	1.00	@	1.05
Krafts	.70	@	.80
New Kraft Cuts	1.15	@	1.25
Manila Env. Cuts	1.25	@	1.30
Ex. No 1 Manila	.90	@	1.00
Print Manila	.30	@	.35
Overissue News	.30	@	.35
Old Newspapers—			
No. 1	.25	@	.30
Mixed Papers—			
No. 1	.15	@	.20
Roofing Stocks—			
No. 1	30.00	@	—
No. 2	28.00	@	—

PHILADELPHIA

Paper
(F. o. b. Mill)

Bonds	.04	@	.40
Ledgers	.06	@	.40
Writings—			
Superfine	.10	@	.18
Extra Fine	.15	@	.26
Fine	.15	@	.26
Fine, No. 2	.10	@	.25
Fine No. 3	.05½	@	.18
Book, M. F.	.04¾	@	.07
Book, S. S. & C.	.05	@	.07½
Book, Coated	.06	@	.16
Coated Lithograph	.06	@	.11
Label	.07	@	.11
No. 1 Jute Manila	.06	@	.09
Manila Sul., No. 1	.03	@	.05
Manila No. 2	.03	@	.04
No. 1 Kraft	.05¼	@	.06
No. 2 Kraft	.03¾	@	.04½
Southern Kraft No. 1	—	@	.03¾
Southern Kraft No. 2	—	@	.02¼
Common Bogus	.03	@	.04

(Delivered Philadelphia)

News Print Rolls	46.00	@	—
Straw Board	32.00	@	—
News Board	30.00	@	—
Chip Board	30.00	@	—
Wood Pulp Board	70.00	@	80.00
Binder Boards—			
No 1. per ton	73.00	@	75.00
No. 2, per ton	62.00	@	65.00
Carload lots	60.00	@	65.00
Tarred Felts—			
Regular	52.25	@	54.25
Slaters (per roll)	.84	@	.94
Best Tarred, 1-ply (per roll)	1.95	@	2.10
Best Tarred, 2-ply (per roll)	1 50	@	1.60
Best Tarred, 3-ply	2.00	@	2.25

Domestic Rags (New)
(Price to Mill, f. o. b. Phila.)

Shirt Cuttings—			
New White, No. 1.	.03½	@	.04
New White, No. 2.	.02½	@	.04
Light Silesias	.02½	@	.03
Silesias, No. 1	.03	@	.03½
Black Silesias, soft.	.02½	@	.03
New Unbleached	.05	@	.05½
Washable, No. 1	.01	@	.01½
Blue Overall	.03	@	.03½
Cottons—According to grades—			
Washable, No. 2	.01	@	.02
New Blue	.01	@	.02
Fancy	.01½	@	—
New Black Soft	.02	@	.03
New Light Seconds	.01	@	.02
New Dark Seconds	1.50	@	1.75
Khaki Cuttings—			
No. 1 O.D.	.03	@	.03½
No. 2 Mixed	.02½	@	.03
Corduroy	.02	@	.02½
New Canvas	.03½	@	.04
New Black Mixed	.02½	@	.03

Domestic Rags (Old)

White No. 1—			
Repacked	2.50	@	3.00
Miscellaneous	1.75	@	2.00
M. G.	3.00	@	3.50
Thirds and Blues—			
Miscellaneous	1.00	@	1.25
Repacked	1.50	@	1.75
Black Stockings (Export)	2.00	@	3.50
Roofing Stock—			
Foreign No. 1	.50	@	.75
Repacked	.70	@	.80

Bagging
(F. o. b. Phila.)

Gunny, No. 1—			
Foreign	1.25	@	1.50
Domestic	1.50	@	—
Manila Rope	2.00	@	2.25
Sisal Rope	1.25	@	1.50
Mixed Rope	1.00	@	1.10
Scrap Burlaps—			
No. 1	1.25	@	1.50
No. 2	.80	@	1.00
Wool Tares, heavy	2.75	@	—
Mixed Strings	1.15	@	1.25
No. 1 New Light Burlap	2.25	@	2.50
New Burlap Cuttings	2.00	@	2.25

Old Papers
(F. o. b. Phila.)

Shavings—			
No. 1 Hard White	1.60	@	1.70
No. 2 Hard White	1.50	@	1.60
No. 1 Soft White	1.25	@	1.30
No. 2 Soft White	1.10	@	1.15
No. 1 Mixed	.50	@	.60
No. 2 Mixed	.40	@	.50
Solid Ledger Stock	1.00	@	1.10
Writing Paper	.75	@	.80
No. 1 Books, heavy	.55	@	—
No. 2 Books, light	.40	@	—
No. 1 New Manila	1.10	@	1.15
No. 1 Old Manila	.75	@	.80
Print Manila	.45	@	.50
Container Manila	.40	@	.45
Old Kraft	.85	@	.90
Common Paper	.20	@	.25
No. 1 Mixed Paper	.25	@	.30
Straw Board, Chip	.25	@	.30
Binders Board, Chip	.25	@	.30
Corrugated Board	.35	@	.45
Overissue News	.45	@	.55
Old Newspaper	.40	@	.50

BOSTON

Paper
(F. o. b. Mill)

Ledgers—			
Sulphite	.06	@	.12½
Rag Content	.12	@	.30
All Rag	.36	@	.52½
Bonds—			
Sulphite	.05½	@	.11½
Rag Content	.12	@	.30
All Rag	.36	@	.65
Writings	.06½	@	.20
Superfines	.11	@	.31
Book, Super	.06	@	.09
Book, M. F.	.05½	@	.08½
Book, Coated	.08½	@	.18
Coated Litho	.09	@	.12
Label	.09½	@	.15
Jute Manila No. 1	.11	@	.13
Manila, Sul. No. 1	.04¾	@	.06¼
Manila, Sul. No. 2	.03¾	@	.04½
No. 1 Kraft	—	@	.04¾
No. 2 Kraft	—	@	.02¾

(F. o. b. Boston)

Southern Kraft	—	@	.02½

(F. o. b. destination in carload lots, f. o. b. mill in less than carload lots.)

Common Bogus	.02	@	.02¾

(Delivered New England points)

News Print, rolls	44.50	@	—
Straw Board, rolls	.009	—	@35.00
Straw Board in Sheets, basis 35s to 70s			@40.00
Filled News Board	—		@30.00
Chip Board	27.50	@	—
Chip Board (Creasing)	27.50		@30.00
Single Manila Lined Chip	—		@37.50
Single White, Patent Coated News Board—			
Bender	45.00		@55.00
Wood Pulp Board	70.00		@75.00
Binder Boards	62.00		@75.00

Old Papers
(F. o. b. Boston)

Shavings—			
No. 1 Soft White	1.55	@	1.65
No. 1 Old Manila	.50	@	.60
No. 2 Mixed	.50	@	.55
No. 1 Mixed	.75	@	.85
Solid Ledger Books	1.20	@	1.40
Overissue Ledger Stock	1.15	@	1.30
Mixed Ledgers	.60	@	.70
No. 1 Books, heavy	.55	@	.65
No. 1 Books, light	—	@	.30
Crumpled Stitchless Book Stock	.50	@	.60
Manila Env. Cuttings	1.25	@	1.30
No. 1 Old Manila	.55	@	.65
White Blank News	.95	@	1.00
No. 1 Kraft	.85	@	.95
Manila	.80	@	.90
No. 1 Mixed Papers	.15	@	.20
Print Manila	.30	@	.40
Overissue News	.35	@	.45
Old Newspapers	.35	@	.40
Box Board, Chip	.17½	@	.20
Corrugated Boxes	.20	@	.25
Screening Wrappers	.25	@	.32½

Bagging
(F. o. b. Boston)

Gunny No. 1—			
Foreign	—	@	1.00
Domestic	.70	@	.75
Manila Rope—			
Foreign	1.25	@	1.45
Domestic	—	@	1.60
Transmission Rope	—	@	.90
Mixing String	—	@	.30
Jute Rope	—	@	.75
Jute Carpet Threads	.25	@	.30
Bleachery Burlap	1.75	@	2.00
Scrap Burlap	.60	@	1.00
No. 1 Scrap Burlap	.75	@	.80
Scrap Sisal	.90	@	—
Scrap Sisal for shredding	—	@	.90
Wool Tares, heavy	.65	@	.75
New Burlap Cutting	.75	@	.90
Australian Wool Pouches	2.00	@	—
Heavy Baling Bagging	.90	@	1.10
Paper Mill Bagging	.50	@	.60
Bagging No. 2	.20	@	.25
No. 1 Burlap	1.75	@	2.00

Domestic Rags (New)
(F. o. b. Boston)

Shirt Cuttings—			
New Light Prints	—	@	.01½
New White No. 1	.03¾	@	.04
New White No. 2	.02¾	@	.03¼
Silesias No. 1	—	@	.03
New Black Silesias	.02½	@	.02¾
New Unbleached	.05	@	.05¼
Fancy	—	@	.02½
Washable	—	@	.01¾
Cottons—According to grades—			
Blue Overalls	—	@	.03¾
New Black, soft	.04	@	.04½
Khaki Cuttings	.03	@	.03¼
O. D. Khaki	.03½	@	.03¾
Corduroy	.02¾	@	.03
New Canvas	—	@	.05
B.V.D. Cuttings	.04	@	.04¼

Domestic Rags (Old)
(F. o. b. Boston)

Canvas	.04½	@	—
White No. 1—			
Repacked	3.00	@	3.50
Miscellaneous	2.00	@	2.25
White No. 2—			
Repacked	.02¼	@	.02½
Miscellaneous	.02	@	.02¼
Twos and Blues	.90	@	1.00
Thirds and Blues—			
Repacked	.75	@	.85
Miscellaneous	.70	@	.75
Black Stockings	2.00	@	2.25
Roofing Stock—			
No. 1	.35	@	.40
No. 2	.30	@	.35
No. 3	.25	@	.30

Foreign Rags
(F. o. b. Boston)

Dark Cottons	.50	@	.60
New No. 1 White Shirt Cuttings	3.75	@	4.00
Dutch Blues	1.25	@	1.50
New Checks & Blues	2.25	@	2.50
Old Fustians	—	@	.75
Old Linsey Garments	.55	@	.65

TORONTO

Paper
(F. o. b. Mill)

Bond—			
No. 1 Sulphite	.10½	@	—
No. 2 Sulphite	.08½	@	—
No. 1 Colored	.10¾	@	
No. 2 Colored	.09	@	.10½
Ledgers (sulphite)	—	@	—
Ledgers, No. 1	.36	@	—
Ledgers, No. 2	.27	@	—
Writing	.09	@	.09½
Book—			
No. 1 M. F. (Carloads)	6.65	@	—
No. 3 M. F. (Carloads)	6.20	@	—
No. 4 M. F. (carloads)	5.25	@	—
No. 1 S. C. (carloads)	7.15	@	—
No. 3 S. C. (carloads)	6.65	@	—
No. 4 S. C. (carloads)	5.70	@	—
No. 1 Coated and Litho	12.50	@	—
No. 2 Coated and Litho	11.50	@	—
No. 3 Coated and Litho	10.00	@	11.50
Coated tinted	14.00	@	—
Wrapping—			
Rag Brown	4.40	@	—
White Wrap	2.00	@	—
"B" Manila	4.90	@	—
No. 1 Manila	5.40	@	—
Fiber	5.40	@	—
Kraft, M. F.	5.75	@	—
Kraft No. 2	5.40	@	—

(F.O.B. Cars Toronto)

News, per ton—			
Rolls (contract)	45.50	@	—
Sheets	50.50	@	—

Pulp
(F. o. b. Mill)

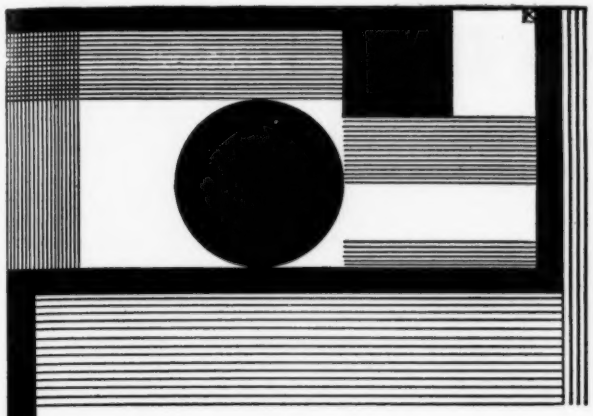
Ground Wood	18.00	@	20.00
Sulphite easy bleaching	40.00	@	—
Sulphite, news grade	38.00	@	—
Sulphite, bleached	48.00	@	58.00
Sulphate	50.00	@	—

Old Waste Paper
(In carload lots, f. o. b. Toronto)

Shavings—			
White Env. Cut	1.80	@	—
Soft White	1.40	@	—
White Blk. News	1.25	@	—
Book and Ledger—			
Flat Magazine and Book Stock (old)	.90	@	—
Light and Crumpled Book Stock	.80	@	—
Ledgers and Writings	1.00	@	—
Manilas—			
New Manila Cut	1.25	@	—
Printed Manilas	.55	@	—
Kraft	1.75	@	—
News and Scrap—			
Strictly Overissue	.50	@	—
Strictly Folded	.50	@	—
No. 1 Mixed Paper	.40	@	—

Domestic Rags
(Price to mills, f. o. b. Toronto)

No 1 White Shirt Cuttings	.09½	@	.10
Fancy Shirt Cuttings	.06	@	.06¼



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PAPER TRADE JOURNAL

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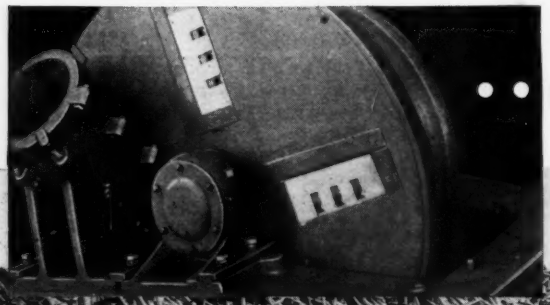
TURNING LOGS *into* CHIPS *for* 9 LONG YEARS



• • • *on the same set of* SKF BEARINGS

A TOUGH job...this business of reducing husky eighteen inch hemlock logs to chips for paper making at the rate of a thousand "bites" a minute...and to keep on doing it day in and day out . . . year in and year out. Yet this pulpwood chipper has been doing *just* that for nine years...and on the same set of SKF Roller Bearings. And for this type of work, nine years is a long, long time!

In spite of varying loads and rigorous service conditions, the SKF Bearings on this chipper show no appreciable signs of wear as the result of their nine years of use. They have performed up to SKF standards. They have reduced power costs. They have demanded little or no maintenance. And today they show every indication of keeping up this performance for many years to come.

The SKF Bearings on this pulpwood chipper tell a story that every manufacturer of a bearing-equipped product should heed: "Nothing is apt to cost so much as a bearing that cost so little."

SKF INDUSTRIES, INC., 40 East 34th St, New York, N. Y.

At top: SKF - equipped woodchipper made by D. J. MURRAY MANUFACTURING COMPANY, Wausau, Wisconsin, and installed in December, 1923 in the Tomahawk Kraft Paper Company's 100 ton mill. It has been in continuous service ever since.

SKF
BALL AND ROLLER BEARINGS

2951

A PROMISE IS ONLY A PROMISE...PERFORMANCE IS HISTORY